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# An Illustrated Key to the Planktonic Rotifers of the Laurentian Great Lakes

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Central Regional Laboratory
536 South Clark Street
Chicago, Illinois 60605

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# AN ILLUSTRATED KEY TO THE PLANKTONIC ROTIFERS OF THE LAURENTIAN GREAT LAKES

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The information contained in this text represents a compilation of data obtained from earlier taxonomic studies as well as data collected by the authors in 1975 and 1977. It is the first comprehensive report describing the planktonic or "open water" rotifers present in all the Great Lakes and is limited to species identified within the past thirty-five years. Rotifers generally associated with littoral or benthic areas but reported amongst the plankton are also described. A summary of the rotifers and the respective lakes where they have been reported is included.

Taxonomic keys are presented to both the genus and species level of classification. Each description is supplemented with photographs and/or drawings of the appropriate species.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Taxonomy<br>Aquatic Biology<br>Ecology<br>Plankton<br>Limnology<br>Zooplankton | Rotifers<br>Laurentian Great Lakes<br>Lake Superior<br>Lake Huron<br>Lake Michigan<br>Lake St. Clair<br>Lake Erie & Lake Ontario | 06C<br>06F |

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# AN ILLUSTRATED KEY TO THE PLANKTONIC ROTIFERS OF THE LAURENTIAN GREAT LAKES

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OCTOBER 1977

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# INTRODUCTION

Many articles have been published on the zooplankton of the Laurentian Great Lakes. Most of these studies however, have concentrated primarily on the larger zooplankters i.e. cladocerans and copepods. Relatively few comprehensive studies have been made of the rotifer fauna (Eddy, 1927; Ahlstrom, 1936; Nauwerck, 1972; Stemberger, 1974; Watson, 1974 and Bricker et al., 1977). The most recent of these studies (Nauwerck, 1972; Stemberger, 1974; Watson, 1974 and Bricker et al., 1977) have helped to fill many of the gaps that existed in some of the earlier investigations.

The information contained in this text represents a compilation of data obtained from earlier taxonomic studies as well as data collected by the authors in 1975 and 1977. It is the first comprehensive report describing the planktonic or "open water" rotifers present in all the Great Lakes and is limited only to species identified within the past thirty-five years. Littoral species found in plankton samples as occasional migrants are also included in the text. These species are labeled to avoid confusion with planktonic forms. Lists of the common and uncommon or rare species and the respective lakes where they have been found appear in Tables 1 and 2, respectively. Organisms were placed in these categories based on observations by the authors and other taxonomists. It must be realized however, that spatial, seasonal, and yearly variations in species abundance and composition do occur in most natural aquatic systems. Consequently, some species that are common during one year or season may be uncommon or rare the next. Individuals interested in some of the earlier taxonomic studies should refer to the bibliography at the end of the text.

The taxonomic descriptions concentrate primarily on external characteristics that are readily observable to aid the general biologist in keying to the genus and species level. These descriptions are supplemented with drawings or photographs of the appropriate species. The reader is encouraged to also use the taxonomic keys, many of which have excellent illustrations, cited at the end of the text.

Although this key is written for the general taxonomist, we believe the photographs and drawings will also be of value to the specialist. Rotifer species previously unreported in the Great Lakes will undoubtedly continue to be discovered as the U.S. and Canadian governments, state agencies, and universities continue their investigations of the Laurentian Great Lakes.

## Table 1
## Common planktonic rotifer species of the Laurentian Great Lakes[1]

| Species | Lake Superior | Lake Michigan | Lake Huron | Lake St. Clair | Lake Erie | Lake Ontario |
|---|---|---|---|---|---|---|
| *Anuraeopsis fissa (Gosse) | | | X | | | |
| *Asplanchna herrioki* de Guerne | | X | | | | |
| *Asplanchna priodonta* Gosse | X | X | X | X | | X |
| *Brachionus angularis* Gosse | | X | | X | X | X |
| *Brachionus bidentata* Anderson | | | X | | | |
| *Brachionus budapestinensis* Daday | | | | X | X | |
| *Brachionus calyciflorus* Pallas | | | X | X | X | X |
| *Brachionus caudatus* Barrois & Daday | | | X | X | | |
| *Brachionus havanaensis* Rousselet | | | X | | X | |
| *Brachionus urceolaris* Muller | | | X | | X | |
| *Chromogaster ovalis* (Bergendal) | | X | X | | | |
| *Collotheca mutabilis* (Hudson) | X | X | X | X | X | X |
| *Collotheca pelagica* (Rousselet) | | | | | X | |
| *Conochiloides dossuarius* (Hudson) | X | | X | X | X | |
| *Conochilus unicornis* Rousselet | X | X | X | X | X | X |
| *Euchlanis dilatata* Ehrenberg | | | | | X | |
| *Filinia longiseta* (Ehrenberg) | X | X | X | X | X | X |
| *Gastropus stylifer* Imhof | X | X | X | X | | |
| *Hexarthra mira* (Hudson) | | | | X | | |
| *Kellicottia bostoniensis* (Rousselet) | | | X | | X | |
| *Kellicottia longispina* (Kellicott) | X | X | X | X | X | X |
| *Keratella cochlearis* (Gosse) | X | X | X | X | X | X |
| *Keratella cochlearis f. hispida* (Lauterborn) | | X | X | X | | X |
| *Keratella cochlearis f. robusta* (Lauterborn) | | | X | | | X |
| *Keratella cochlearis f. tecta* (Gosse) | | | X | X | X | |
| *Keratella crassa* Ahlstrom | X | X | X | X | X | X |
| *Keratella earlinae* Ahlstrom | | X | X | X | X | X |
| *Keratella hiemalis* Carlin | | | X | | X | X |
| *Keratella irregularis* (Lauterborn) | | | | | | X |
| *Keratella quadrata* (Muller) | X | X | X | X | X | X |
| *Keratella taurocephala* Myers | | | | | X | |
| *Keratella valga* (Ehrenberg) | | | | X | | |
| *Notholca acuminata* (Ehrenberg) | X | | X | | X | X |
| *Notholca foliacea* (Ehrenberg) | | X | X | | X | |
| *Notholca laurentiae* Stemberger | X | X | X | X | X | X |
| *Notholca squamula* (Muller) | X | X | X | | X | X |
| *Ploesoma hudsoni* (Imhof) | | X | X | | X | X |
| *Ploesoma lenticulare* Herrick | | X | X | X | X | |
| *Ploesoma truncatum* (Levander) | | X | X | X | | X |
| *Polyarthra dolichoptera* Idelson | | X | X | | X | X |
| *Polyarthra euryptera* Wierzejski | | X | X | | X | |
| *Polyarthra major* Burckhardt | X | X | X | X | X | X |
| *Polyarthra remata* Skorikov | | X | X | X | X | X |
| *Polyarthra vulgaris* Carlin | X | X | X | X | X | X |
| *Pompholyx sulcata* Hudson | | | X | | X | |
| *Synchaeta asymmetrica* Koch-Althaus | | X | X | | | |
| *Synchaeta lakowitziana* Lucks | | X | X | | | X |
| *Synchaeta oblonga* Ehrenberg | | X | X | | | |
| *Synchaeta pectinata* Ehrenberg | | X | X | | X | X |
| *Synchaeta stylata* Wierzejski | | X | X | X | X | X |
| *Synchaeta sp.* | X | X | X | X | X | X |
| *Trichocerca cylindrica* (Imhof) | | | X | X | X | X |
| *Trichocerca multicrinis* (Kellicott) | | X | X | X | X | X |
| *Trichocerca porcellus* (Gosse) | | X | X | | | X |
| *Trichocerca rousseleti* (Voigt) | | X | X | | | |

* Generally found in littoral or benthic areas; only occasional migrant in plankton.

[1] Species reported from harbor areas are not included.

## Table 2
## Uncommon or rare planktonic rotifer species of the Laurentian Great Lakes[1]

| Species | Lake Superior | Lake Michigan | Lake Huron | Lake St. Clair | Lake Erie | Lake Ontario |
|---|---|---|---|---|---|---|
| *Asplanchna herrioki* de Guerne | | | | X | X | |
| *Asplanchna priodonta* Gosse | | | | | X | |
| *[*]Brachionus bidentata* Anderson | | | | X | | |
| *[*]Brachionus calyciflorus* Pallas | | X | | | | |
| *[*]Brachionus caudatus* Barrois & Daday | | X | | | X | |
| *Brachionus diversicornis* (Daday) | | | | | X | |
| *[*]Brachionus havanaensis* Rousselet | | | | X | | |
| *[*]Brachionus quadridentatus* Hermann | | | | X | X | |
| *[*]Brachionus rubens* Ehrenberg | | | | X | | |
| *[*]Brachionus urceolaris* Muller | | | | X | | |
| *[*]Cephalodella gibba* (Ehrenberg) | | X | | X | X | |
| *Chromogaster ovalis* (Bergendal) | | | | X | X | X |
| *Collotheca pelagica* (Rousselet) | | X | | | | |
| *Conochiloides dossuarius* (Hudson) | | X | | | | X |
| *Conochilus hippocrepis* (Schrank) | | X | | | | |
| *[*]Euchlanis deflexa* Gosse | | | | X | | |
| *Euchlanis dilatata* Ehrenberg | | | | X | | X |
| *[*]Euchlanis oropha* Gosse | | | | X | | |
| *[*]Euchlanis parva* Rousselet | | | | | X | |
| *[*]Euchlanis triquetra* Ehrenberg | | X | | X | X | |
| *Filinia terminalis* (Plate) | | | | | | X |
| *Gastropus stylifer* Imhof | | | | | X | X |
| *Hexarthra mira* (Hudson) | | | | | X | |
| *Kellicottia bostoniensis* (Rousselet) | | | | | | X |
| *Keratella cochlearis f. falcata* Ahlstrom | | | | | | X |
| *Keratella cochlearis f. hispida* (Lauterborn) | | | | | X | |
| *Keratella cochlearis f. robusta* (Lauterborn) | | | | | X | |
| *Keratella cochlearis f. tecta* (Gosse) | | X | | | | X |
| *Keratella hiemalis* Carlin | | X | | | | |
| *Keratella taurocephala* Myers | | | | | | X |
| *[*]Lecane luna* (Muller) | | X | | X | X | |
| *[*]Lepadella patella* (Muller) | | X | | X | | |
| *[*]Monostyla bulla* Gosse | | | | X | | |
| *[*]Monostyla lunaris* (Ehrenberg) | | X | | X | | |
| *[*]Monostyla quadridentata* Ehrenberg | | | | X | | |
| *Notholca acuminata* (Ehrenberg) | | X | | X | | |
| *Notholca foliacea* (Ehrenberg) | | | | X | | X |
| *Notholca squamula* (Muller) | | | | X | | |
| *[*]Platyias patulus* (Muller) | | X | | X | X | |
| *Ploesoma hudsoni* (Imhof) | | | | X | | |
| *Ploesoma truncatum* (Levander) | | | | | X | |
| *Polyarthra euryptera* Wierzejski | | | | X | | |
| *Pompholyx sulcata* Hudson | | X | | X | | X |
| *Synchaeta oblonga* Ehrenberg | | | | | | X |
| *[*]Testudinella patina* (Hermann) | | | | X | | |
| *[*]Trichocerca lata* (Jennings) | | | | X | X | |
| *Trichocerca longiseta* (Schrank) | | | | | X | X |
| *[*]Trichocerca mucosa* (Stokes) | | | | X | | |
| *[*]Trichocerca porcellus* (Gosse) | | | | X | | |
| *Trichocerca pusilla* (Jennings) | | X | | X | X | |
| *Trichocerca rousseleti* (Voigt) | | | | X | | |
| *Trichocerca similis* (Wierzejski) | | | | X | X | |
| *[*]Trichocerca stylata* (Gosse) | | X | | X | | |
| *[*]Trichotria tetractis* (Ehrenberg) | | X | | X | | |
| *Tylotrocha monopus* (Jennings) | | X | | X | | |

[*] Generally found in littoral or benthic areas; only occasional migrant in plankton.

[1] Species reported from harbor areas are not included.

## MORPHOLOGY

Rotifers exhibit considerable variability in morphology and are represented by both loricate and illoricate forms. The rotifer body can generally be differentiated into a head, trunk, and foot. Figure 1 illustrates some of the general morphological features characteristic of many species. The anterior end (head) contains a ciliated corona which functions primarily as a means of locomotion as well as for directing food into the mouth. A foot may be present in some species and absent in others. When a foot is present, it will often bear one or two toes.

Several methods of feeding are displayed among rotifers. One of the most common methods involves the movement of the coronal cilia which create small water currents. These currents direct plankton and detritus into the mouth, whereupon particles of suitable size are ingested (Pennak, 1953). The food is then mechanically broken down by the mastax which contains jaw-like structures known as trophi. Some rotifers obtain their food by thrusting out their trophi which grasp the prey and directs the food into the stomach. A third method utilizes the trophi to pierce the prey and then a "sucking" mechanism to ingest the body contents.

The type of trophi is an important taxonomic feature used to distinguish rotifer genera. Figure 2 illustrates the eight major types of trophi: malleate, virgate, forcipate, incudate, ramate, malleoramate, and uncinate. These structures can be observed by placing the specimen on a depression microscope slide containing a 10 percent solution of sodium hypochlorite (Chlorox bleach). The sodium hypochlorite dissolves the soft parts leaving only the trophi for easy observation (Myers, 1937).

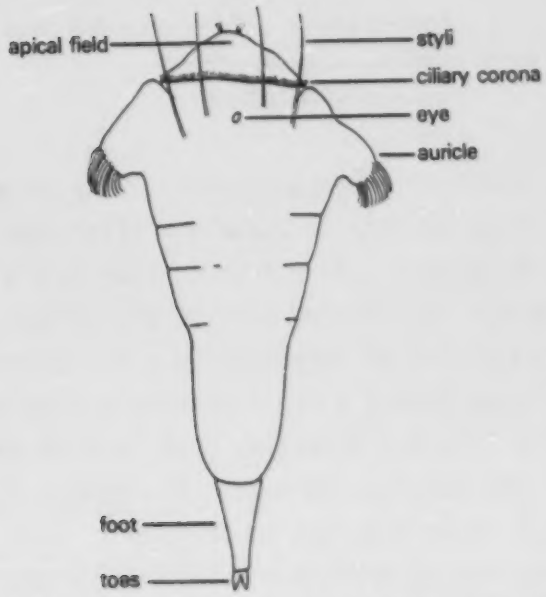



**Fig. 1:** Major morphological structures of *Synchaeta grandis* (Redrawn from Voigt, 1957).

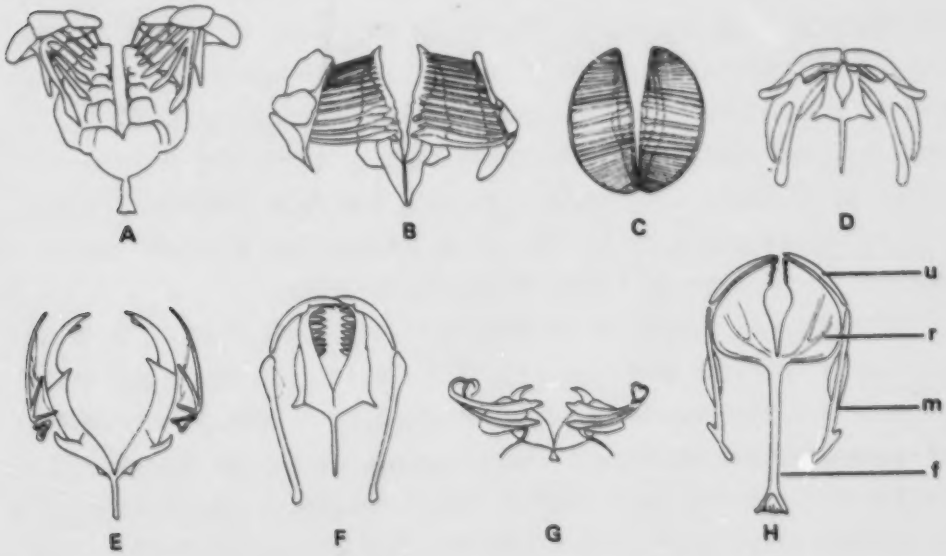



**Fig. 2:** 8 major types of rotifer trophi:
A - malleate anterior view; B - malleoramate anterior view; C - ramate anterior view;
D - cadate ventral view; E - incudate anterior view; F - forcipate anterior view;
G - uncinate anterior view; H - virgate ventral view [f - fulcrum; m - manubrium;
r - ramus; u - uncus . (A-H redrawn from Pennak, 1953).

## REPRODUCTION

Most rotifers reproduce by a process known as heterogony which involves both parthenogenetic development and sexual phases. The parthenogenetic cycle involves the laying of diploid eggs which do not require fertilization. The laying of such eggs by the female aids in the rapid colonization of an area. The sexual phase consists of the formation of haploid eggs in the female which may or may not be fertilized by the male. When eggs are not fertilized, they are released and eventually develop into males (Pennak, 1953). If fertilization occurs, the dormant eggs that are produced are resistant to unfavorable environmental conditions. Although most planktonic forms carry their eggs, other species may lay the eggs in the open water or on aquatic plants and other surfaces. Some rotifers such as *Asplanchna* give birth to living young.

## COLLECTION AND PRESERVATION

The presence of rotifers in a wide variety of habitats makes it necessary to employ different methods of collection depending upon whether planktonic, littoral, or sessile forms are desired. Planktonic species may be obtained by making horizontal, oblique, or vertical tows with a No. 25 (64.0 μ) mesh plankton net. A Van Dorn, Niskin, or other suitable sampling device can be used to collect water samples in areas that are too shallow or weedy for towing devices. The organisms are then concentrated by filtering the water sample through a special plankton funnel fitted with a 53 μ mesh net (Likens and Gilbert, 1970). This method is also useful for the collection of species too small to be retained by a No. 25 mesh net and when net clogging is a problem. Sweeping through the aquatic vegetation with a long handled-

shallow plankton net is a good method for collection of rotifers commonly found in littoral areas. Sessile or attached rotifers can be obtained from material on the bottom such as logs, rocks, etc., and from the surface of aquatic plants.

Rotifers are generally preserved in 5 per cent formalin. Formalin however, will often cause the organism to retract. The addition of carbonated water in a ratio of 1:20 (carbonated water to lake water) before the addition of formalin will narcotize the specimens and thus help prevent retraction of body parts (Gannon and Gannon, 1975).

## TAXONOMIC LIST OF THE PLANKTONIC ROTIFERS OF THE LAURENTIAN GREAT LAKES

Class Monogononta

Order Ploima

Family Brachionidae

Subfamily Brachioninae

Genus *Anuraeopsis* Lauterborn, 1900

* *Anuraeopsis fissa* (Gosse, 1951)

Genus *Brachionus* Pallas, 1766

*Brachionus angularis* Gosse, 1851

* *Brachionus bidentata* Anderson, 1889

*Brachionus budapestinensis* Daday, 1885

* *Brachionus calyciflorus* Pallas, 1766

* *Brachionus caudatus* Barrois and Dady, 1894

*Brachionus diversicornis* (Daday, 1883)

* *Brachionus havanaensis* Rousselet, 1911

* *Brachionus quadridentatus* Hermann, 1783

* *Brachionus rubens* Ehrenberg, 1838

* *Brachionus urceolaris* Muller, 1773

Genus *Euchlanis* Ehrenberg, 1832

* *Euchlanis dilexa* Gosse, 1851

* *Generally found in littoral or benthic areas; only occasional migrant in plankton.*

*Euchlanis dilatata* Ehrenberg, 1832

* *Euchlanis oropha* Gosse, 1887

* *Euchlanis parva* Rousselet, 1892

* *Euchlanis triquetra* Ehrenberg, 1838

Genus *Kellicottia* Ahlstrom, 1938

*Kellicottia bostoniensis* (Rousselet, 1908)

*Kellicottia longispina* (Kellicott, 1879)

Genus *Keratella* Bory de St. Vincent, 1822

*Keratella cochlearis* (Gosse, 1851)

*Keratella cochlearis f. faluta* Ahlstrom, 1943

*Keratella cochlearis f. hispida* (Lauterborn, 1898)

*Keratella cochlearis f. robusta* (Lauterborn, 1900)

*Keratella cochlearis f. tecta* (Gosse, 1851)

*Keratella crassa* Ahlstrom, 1943

*Keratella earlinae* Ahlstrom, 1943

*Keratella hiemalis* Carlin, 1943

*Keratella irregularis* (Lauterborn, 1898)

*Keratella quadrata* (Muller, 1786)

*Keratella taurocephala* Myers, 1938

*Keratella valga* (Ehrenberg, 1834)

Genus *Notholca* Gosse, 1886

*Notholca acuminata* (Ehrenberg, 1832)

*Notholca foliacea* (Ehrenberg, 1838)

*Notholca laurentiae* Stemberger, 1976

*Notholca squamula* (Muller, 1786)

* Genus *Platyias* Harring, 1913

* *Platyias patulus* (Muller, 1786)

* Genus *Trichotria* Bory de St. Vincent, 1827

* *Trichotria tetractis* (Ehrenberg, 1830)

Subfamily Colurinae

* Genus *Lepadella* Bory de St. Vincent, 1826

* *Lepadella patella* (Muller, 1786)

Family Lecanidae

* Genus *Lecane* Nitzsch, 1827

* *Lecane luna* (Muller, 1776)

* Genus *Monostyla* Ehrenberg, 1830

* *Monostyla bulla* Gosse, 1851

* *Monostyla lunaris* (Ehrenberg, 1832)

* *Monostyla quadridentata* Ehrenberg, 1832

Family Notommatidae

* Genus *Cephalodella* Bory de St. Vincent, 1826

* *Cephalodella gibba* (Ehrenberg, 1832)

Family Trichocercidae

Genus *Trichocerca* Lamarck, 1801

*Trichocerca cylindrica* (Imhof, 1891)

* *Trichocerca lata* (Jennings, 1894)

*Trichocerca longiseta* (Schrank, 1793)

* *Trichocerca mucosa* (Stokes, 1896)

*Trichocerca multicrinis* (Kellicott, 1897)

* *Trichocerca porcellus* (Gosse, 1851)

*Trichocerca pusilla* (Jennings, 1902)

*Trichocerca rousseleti* (Voigt, 1902)

*Trichocerca similis* (Wierzejski, 1893)

* *Trichocerca stylata* (Gosse, 1851)

Family Gastropodidae

Genus *Chromogaster* Lauterborn, 1893

*Chromogaster ovalis* (Bergendal, 1892)

Genus *Gastropus* Imhof, 1898

*Gastropus stylifer* Imhof, 1891

Family Tylotrochidae

Genus *Tylotrocha* Harring and Myers, 1922

*Tylotrocha monopus* (Jennings, 1894)

Family Asplanchnidae

Genus *Asplanchna* Gosse, 1850

*Asplanchna herricki* de Guerne, 1888

*Asplanchna priodonta* Gosse, 1850

Family Synchaetidae

Genus *Ploesoma* Herrick, 1885

*Ploesoma hudsoni* (Imhof, 1891)

*Ploesoma lenticulare* Herrick, 1885

*Ploesoma truncatum* (Levander, 1894)

Genus *Polyarthra* Ehrenberg, 1834

*Polyarthra dolichoptera* Idelson, 1925

*Polyarthra euryptera* Wierzejski, 1891

*Polyarthra major* Burckhardt, 1900

*Polyarthra remata* Skorikov, 1896

*Polyarthra vulgaris* Carlin, 1943

Genus *Synchaeta* Ehrenberg, 1832

*Synchaeta asymmetrica* Koch-Althaus, 1963

*Synchaeta lakowitziana* Lucks, 1930

*Synchaeta oblonga* Ehrenberg, 1832

*Synchaeta pectinata* Ehrenberg, 1832

*Synchaeta stylata* Wierzejski, 1893

Order Flosculariaceae

Family Testudinellidae

Genus *Filinia* Bory de St. Vincent, 1824

*Filinia longiseta* (Ehrenberg, 1834)

*Filinia terminalis* (Plate, 1886)

Genus *Pompholyx* Gosse, 1851

*Pompholyx sulcata* Hudson, 1885

Genus *Testudinella* Bory de St. Vincent, 1826

* *Testudinella patina* (Hermann, 1783)

Family Hexarthridae

Genus *Hexarthra* Schmarda, 1854

*Hexarthra mira* (Hudson, 1871)

Family Conochilidae

Genus *Conochiloides* Hlava, 1904

*Conochiloides dossuarius* (Hudson, 1885)

Genus *Conochilus* Ehrenberg, 1834

*Conochilus hippocrepis* (Schrank, 1803)

*Conochilus unicornis* Rousselet, 1892

Order Collothecaceae

Family Collothecidae

Genus *Collotheca* Harring, 1913

*Collotheca mutabilis* (Hudson, 1885)

*Collotheca pelagica* (Rousselet, 1893)

## KEY TO THE GENERA OF PLANKTONIC ROTIFERS OF THE LAURENTIAN GREAT LAKES

1. Single ovary . . . . . Class Monogononta 2
   Paired ovaries . . . . . Class Digononta *

2. Foot or foot opening present (foot may be retracted). . . . . 3
   Foot absent . . . . . 19

3. Foot segmented . . . . . 4
   Foot unsegmented or annulated . . . . . 9

4. Foot composed of two segments (first segment in some species may not be readily observable) . . . . . 5
   Foot composed of three segments (first segment in some species may not be readily observable) . . . . . 7

5. Foot terminates in single toe. Anterior margin of lorica with shallow or deep V-shaped sinus (Plate X).
   . . . . . *Monostyla* (p. 34).
   Foot terminates in two toes . . . . . 6

6. Posterior margin of dorsal plate divided medially by deep inverted U or V-shaped notch (Plates III & IV).
   . . . . . *Euchlanis* (p. 23).
   Posterior margin of dorsal plate not divided medially by inverted U or V-shaped notch (Plate X).
   . . . . . *Lecane* (p. 33).

7. Two posterior spines present. Anterior margin with two or ten spines. Foot opening may be bordered by two short spines (Plate IX).
   . . . . . *Platyias* (p. 32).
   Posterior spines absent . . . . . 8

* Representatives of the class Digononta do not comprise the common rotifer species found in the Great Lakes.

8. Head and neck region clearly defined from rest of body. Second foot segment often bears two spines of varying length (Plate IX).

. . . . . *Trichotria* (p. 32).

Head and neck region not clearly defined from rest of body. Second foot segment lacks spines. Anterior margin with wide U-shaped sinus (Plate IX).

. . . . . *Lepadella* (p. 33).

9. Foot annulated . . . . . 10

Foot unsegmented, smooth or not annulated . . . . . 14

10. Foot with one or two short or minute toes . . . . . 11

Foot without toes, terminates in ciliary band. Two eye spots present (Plate XVIII).

. . . . . *Testudinella* (p. 45).

11. Anterior dorsal margin with two, four, or generally six spines. Posterior spines often present (Plates I - III).

. . . . . *Brachionus* (p. 20).

Anterior dorsal margin without spines . . . . . 12

12. Lorica with numerous ridges forming various textures (Plate XV).

. . . . . *Ploesoma* (p. 40).

Lorica not as above . . . . . 13

13. Body irregularly ovate and compressed laterally. Foot opening located medially or posteriorly on ventral plate (Plate XIV).

. . . . . *Gastropus* (p. 38).

Body slender and spindle-shaped. Foot located terminally (Plate XIV).

. . . . . *Tylotrocha* (p. 39).

14. Two toes present . . . . . 15

Toes absent . . . . . 17

15. Toes of unequal length. Right toe (dorsal view) obscure or reduced. Left toe very long (Plates XI - XIII).

. . . . . *Trichocerca* (p. 35).

Toes of equal or nearly equal length . . . . . 16

16. Body cylindrical. Lateral fissure present along length of body. Toes long, slender, and tapered to point (Plate XI).

. . . . . *Cephalodella* (p. 35).

Body conical or vase-shaped. Round prominent ciliated auricles present on each side of head. Lateral fissure absent (Plate XVII).

. . . . . *Synchaeta* (p. 42).

17. Lateral antennae prominent . . . . . 18

Lateral antennae absent or not prominent. Coronal funnel may or may not have lobes. When present, lobes have bristles (Plate XX).

. . . . . *Collotheca* (p. 47).

18. Two lateral antennae located on ventral surface below corona. Lateral antennae may be fused. Dorsal antennae small. Body tapers to long unsegmented, retractile foot (Plate XIX).

. . . . . *Conochiloides* (p. 46).

Two lateral antennae located on apical field. Lateral antennae may be fused. Dorsal antennae absent. Body tapers to long, unsegmented, retractile foot (Plate XIX).

. . . . . *Conochilus* (p. 46).

19. Anterior margin with spines . . . . . 20

Anterior margin without spines . . . . . 22

20. Areolate pattern present on dorsal surface. Anterior margin with six spines. One or two posterior spines often present (Plates V - VII).

. . . . . *Keratella* (p. 25).

Dorsal surface smooth or striated, areolate pattern absent . . . . . 21

21. Spines on anterior margin bilaterally symmetrical. Posterior margin rounded or terminates in generally broad spine of varying length which does not taper to point in most species (Plate VIII).

. . . . . *Notholca* (p. 30).

Spines on anterior margin located asymmetrically. Body terminates in long tapered caudal spine (Plate V).

. . . . . *Kellicottia* (p.25 ).

22. Body with foliate or paddle-like appendages . . . . . 23

Body without foliate or paddle-like appendages . . . . . 24

23. Body with six hollow appendages bearing long bristles at tips (Plate XIX).

. . . . . *Hexarthra* (p. 45).

Body with two bundles of foliate appendages on both the dorsal and ventral surfaces (Plate XVI).

. . . . . *Polyarthra* (p. 41).

24. Anterior margin with two long filaments. Posterior margin with terminal or subterminal filament-like structure (Plate XVIII).

. . . . . *Filinia* (p. 44).

Anterior and posterior margins without filament-like structures . . . . . 25

25. Distinct keel present. Body oblong or boat-shaped. Posterior margin truncate or tapered (Plate I).

. . . . . *Anuraeopsis* (p. 20).

Keel absent . . . . . 26

26. Lorica generally with four longitudinal grooves; four-lobed in cross section (Plate XVIII).

. . . . . *Pompholyx* (p. 44).

Lorica without longitudinal grooves . . . . . 27

27. Body highly transparent with internal organs clearly visible. Head sparsely ciliated with single row of cilia (Plate XIV).

. . . . . *Asplanchna* (p. 39).

Body not highly transparent. Corona bears finger-shaped process (Plate XIV).

. . . . . *Chromogaster* (p. 38).

# KEY TO THE SPECIES OF PLANKTONIC ROTIFERS OF THE LAURENTIAN GREAT LAKES

## *ANURAEOPSIS* Lauterborn, 1900

Body oblong or boat-shaped. Posterior margin truncate or tapered. Keel present. Lorica lacks spines. Foot absent. Trophi malleate.

1. Body oblong and truncated posteriorly.

   A large diverging mass-like structure (Webers organ) may protrude from posterior margin. Total length 92-105 μ (Plate I,1).
   Generally found in littoral areas; only occasional migrant in plankton.

   .....*Anuraeopsis fissa*

Ref.: Donner, 1943; Gosse, 1851; Pennak, 1953; Sudzuki, 1964.

## *BRACHIONUS* Pallas, 1766

Body shape highly variable; ovate to subrectangular. Lorica usually divided into a dorsal and ventral plate. Anterior dorsal margin with two to six spines. Location of foot opening variable but generally present at posterior end. Foot often retracted. Foot opening may be bordered by two short spines. Posterior spines common. Trophi malleate.

1. Lateral and intermediate anterior spines obscure or reduced.....2

   Lateral and intermediate anterior spines not obscure or reduced.....3

2. Posterior spines present.

Body ovate. Anterior dorsal margin with two small median spines separated by U-shaped aperture. Foot opening a U-shaped aperture in ventral plate. Posterior spines broad and of variable length. Total length 122-354 μ (Plate II,2).

Generally found in littoral areas; only occasional migrant in plankton.

..... *Brachionus caudatus*

Posterior spines absent.

Body ovate. Anterior dorsal margin with two small median spines separated by a U-shaped opening. Foot opening large, often variable in shape and bordered by two short spines. Total length 91-202 μ (Plate I,2).

..... *Brachionus angularis*

3. Lateral anterior spines much longer than median anterior spines.....4

Lateral anterior spines equal to or shorter than median anterior spines.....6

4. Anterior dorsal margin with six spines .....5

Anterior dorsal margin with four spines.

Body ovate. Two unequal, diverging posterior spines present. Right posterior spine (dorsal view) usually longer than left but may be of nearly equal length. Total length 304-565 μ (Plate II,3).

..... *Brachionus diversicornis*

5. Right posterior spine (dorsal view) generally much longer than left posterior spine.

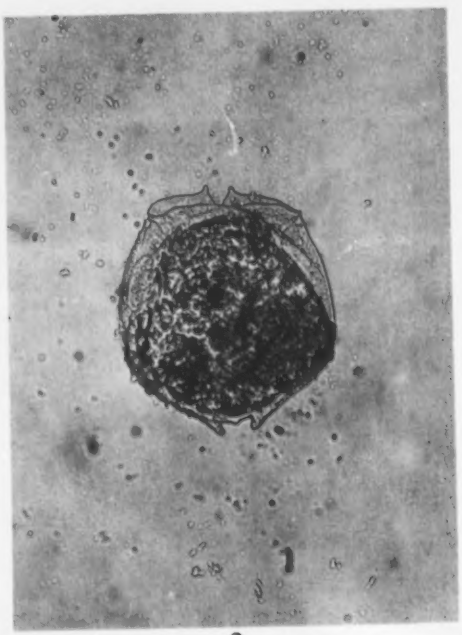
Body oblong or subrectangular. Intermediate anterior spines minute. Distance between bases of posterior spines is small. Total length 135-350 μ (Plate II,4).

Generally found in littoral areas; only occasional migrant in plankton.

..... *Brachionus havanaensis*

**PLATE I**

1



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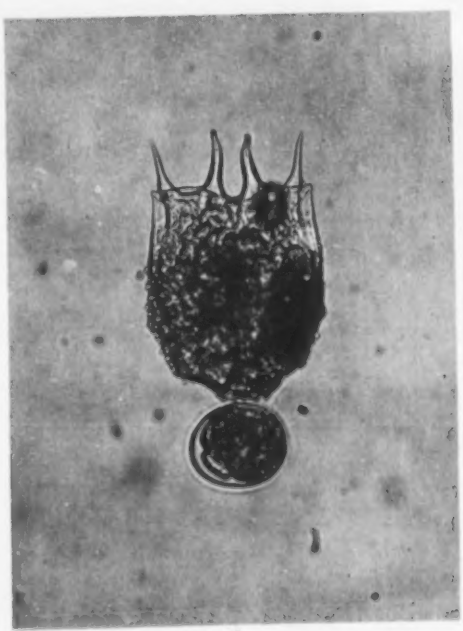

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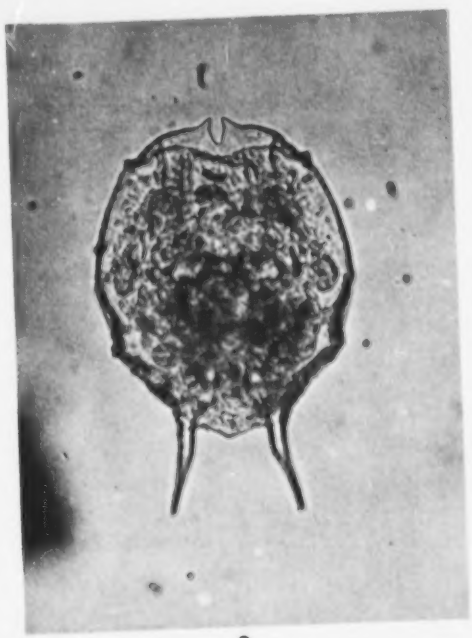
**Figs. 1-4:** 1. *Anuraeopsis fissa* dorsal view; 2. *Brachionus angularis* ventral view; 3. *B. bidentata* ventral view; 4. *B. budapestinensis* dorsal view. (1 redrawn from Donner, 1943).

**PLATE II**

1



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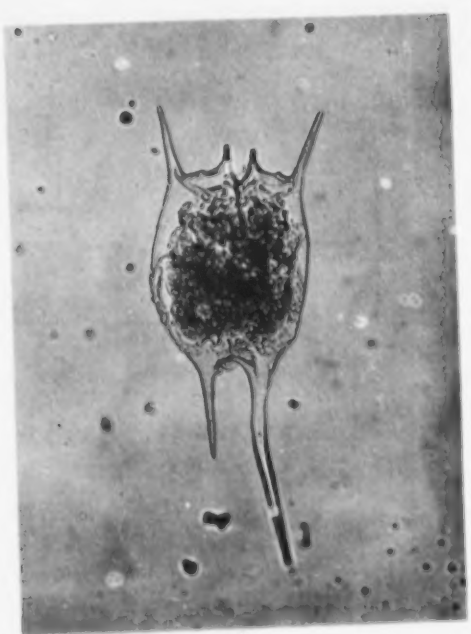

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**Figs. 1-4:** 1. *Brachionus calyciflorus* dorsal view; 2. *B. caudatus* ventral view; 3. *B. diversicornis* ventral view; 4. *B. havanaensis* dorsal view.

Posterior spines of nearly equal length.

Body subrectangular. Intermediate anterior spines shorter than lateral and median anterior spines. Well-developed sheath projects from foot opening. Total length 175-578 μ (Plate I,3).

Generally found in littoral areas; only occasional migrant in plankton.

..... *Brachionus bidentata*

6. Anterior dorsal margin with six spines.....7

Anterior dorsal margin with four spines.....9

7. Body oblong or ovate.....8

Body subrectangular.

Median spines often much longer than lateral and intermediate spines. Medians divergent and separated by V-shaped opening. Two posterior spines of variable length usually present. Total length 188-418 μ (Plate III,1).

Generally found in littoral areas; only occasional migrant in plankton.

..... *Brachionus quadridentatus*

8. Lorica smooth, without pattern.

Median and intermediate spines exhibit distinctive asymmetric shape: anterior portion is narrow but then diverges markedly outward to form broad base. Median spines separated by deep U-shaped opening. Intermediate spines shorter than medians. Foot opening in ventral plate truncate-oval or V-shaped. Posterior spines absent. Total length 154-274 μ (Plate III,2).

Generally found in littoral or benthic areas; only occasional migrant in plankton.

..... *Brachionus rubens*

Lorica with wavy longitudinal lines.

Resembles *Brachionus rubens* however, anterior dorsal spines are nearly symmetrical in shape and do not exhibit peculiar form distinctive of *Brachionus rubens*. Foot

opening on ventral plate generally large and oval-shaped; shape however, variable. Total length 185-280 μ (Plate III,3).
Generally found in littoral or benthic areas; only occasional migrant in plankton.

..... *Brachionus urceolaris*

9. Postero-lateral spines present.

Body oblong or subrectangular. Foot opening often bordered by two spines. Total length 180-570 μ (Plate II,1).
Generally found in littoral areas; only occasional migrant in plankton.

..... *Brachionus calyciflorus*

Postero-lateral spines absent.

Body oblong. Foot opening with V-shaped aperture in dorsal plate. Total length 115-170 μ (Plate I,4).

..... *Brachionus budapestinensis*

Ref.: Ahlstrom, 1940; Gosse, 1851; Pejler, 1957; Pennak, 1953
Sudzuki, 1964.

## *EUCHLANIS* Ehrenberg, 1832

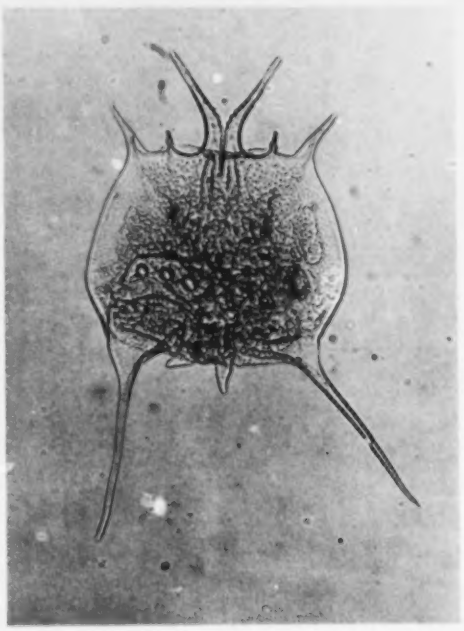
Body ovate in ventral view. Anterior margin of lorica truncate; posterior margin rounded. Dorsal plate shield-like. Posterior margin of dorsal plate divided medially by deep inverted U or V-shaped notch. Foot composed of two segments. Second segment bears two toes which are tapered. Trophi malleate.

1. Dorsal anterior margin with distinct notch.

Posterior margin rounded or with only shallow indentation. Foot broad. Two pairs of long setae present on dorsal end of first foot joint. Toes short and stout. Body length 280 μ (Plate III,4).
Generally found in littoral areas; only occasional migrant in plankton.

.. ..... *Euchlanis deflexa*

**PLATE III**



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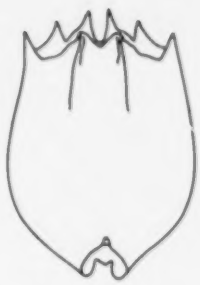

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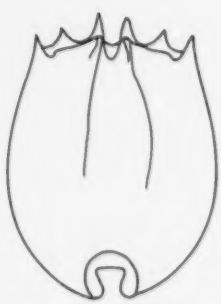

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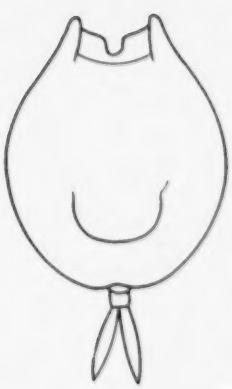

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**Figs. 1-4:** 1. *Brachionus quadridentatus* dorsal view: 2. *B. rubens* ventral view; 3. *B. urceolaris* ventral view; 4. *Euchlanis deflexa* ventral view. (2,3 redrawn from Ahlstrom, 1940; 4 redrawn from Myers, 1930).

Dorsal anterior margin with only shallow indentation.....2

2. Toe length over one-third body length.

Resembles *Euchlanis dilatata* however, body smaller. Foot slender. Toes long and slender. Toes sharply pointed. Body length 125-140 µ (Plate IV,4).
Generally found in littoral areas; only occasional migrant in plankton.

..... *Euchlanis parva*

Toe length one-third or less body length.....3

3. Dorsal plate highly arched.

Posterior margin with distinct inverted V-shaped notch. Foot slender. One pair of long setae present on distal end of first foot joint. Toes slender. Toe length approximately one-third length of dorsal plate. Body length 180-240 µ (Plate IV,5&6).
Generally found in littoral areas; only occasional migrant in plankton.

..... *Euchlanis triquetra*

Dorsal plate not highly arched.....4

4. Foot slender.

Posterior margin with deep inverted U-shaped notch. One pair of long setae present on distal end of first foot joint. Toes slender. Toe length approximately one-third length of dorsal plate. Body length 170-270 µ (Plate IV, 1&2).

..... *Euchlanis dilatata*

Foot broad.

Resembles *Euchlanis dilatata*. Toe length approximately one-fourth length of dorsal plate. Toes sharply pointed. Body length 180-200 µ (Plate IV,3).
Generally found in littoral areas; only occasional migrant in plankton.

..... *Euchlanis oropha*

Ref.: Amren, 1964; Bulow, 1954; Gosse, 1851; Herrick, 1885; Myers, 1930; Pejler, 1962a; Wulfert, 1956.

## *KELLICOTTIA* Ahlstrom. 1938

Body conical, terminating in very long caudal spine. Anterior dorsal margin with four to six spines of varying length. Spines located asymmetrically. Foot absent. Trophi malleate.

1. Anterior dorsal margin with four spines.

   Total length 364 µ (Plate V,1).
   ..... *Kellicottia bostoniensis*

   Anterior dorsal margin with six spines.

   Total length 460-795 µ (Plate V,2).
   ..... *Kellicottia longispina*

Ref.: Ahlstrom, 1938; Amren, 1964; Arnemo et. al., 1968; Nauwerck, 1972; Pennak, 1953.

## *KERATELLA* Bory de St. Vincent, 1822

Anterior dorsal margin with six spines. One or two posterior spines generally present. Spine located medially on posterior margin when only one posterior spine present. Dorsal and ventral plates covered with fine areolate pattern of complete and incomplete polygons (irregular pentagons and hexagons, Fig. 3). Pustulation often present. Trophi malleate.

1. Lorica terminates in two posterior spines.....2

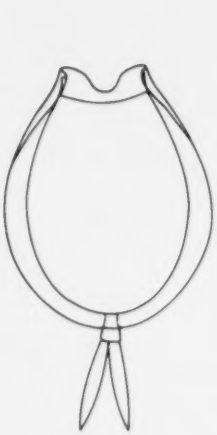
   Lorica not as above.....4

2. Posterior spines approximately equal length.....3

   Posterior spines of unequal length.

   Left spine (dorsal view) may be absent. If present,

## PLATE IV



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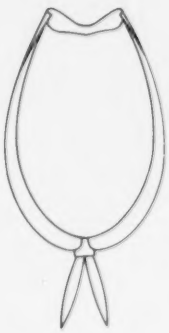

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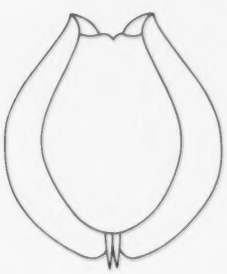

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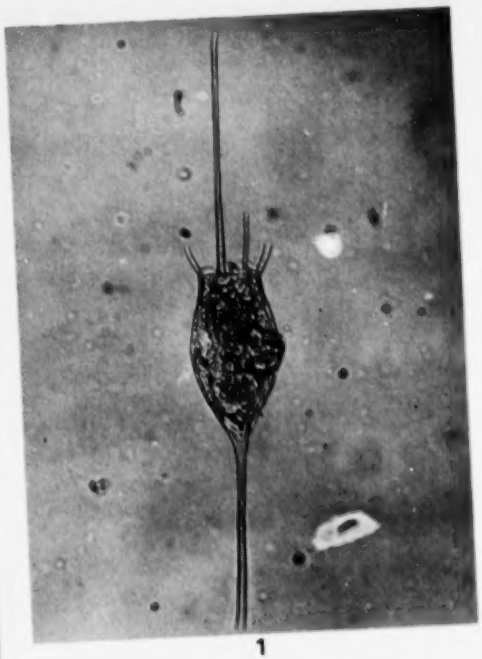
**Figs. 1-6:** 1. *Euchlanis dilatata* ventral view; 2. *E. dilatata* lateral view; 3. *E. oropha* ventral view; 4. *E. parva* ventral view; 5. *E. triquetra* lateral view; 6. *E. triquetra* ventral view. (1-6 redrawn from Myers, 1930).

## PLATE V



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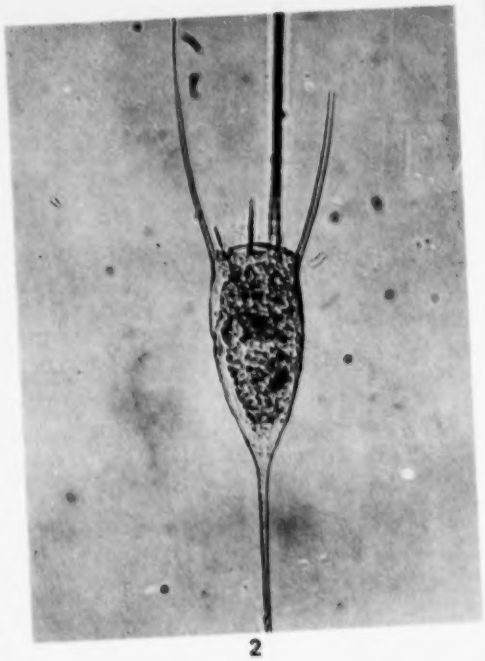

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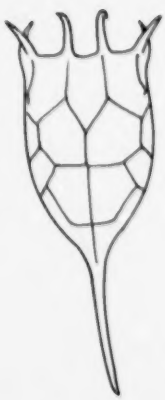

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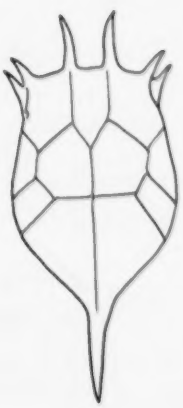

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**Figs. 1-4:** 1. *Kellicottia bostoniensis* dorsal view; 2. *K. longispina* dorsal view; 3. *Keratella cochlearis* dorsal view; 4. *K. cochlearis f. faluta* dorsal view. (3, 4 redrawn from Ahlstrom, 1943).

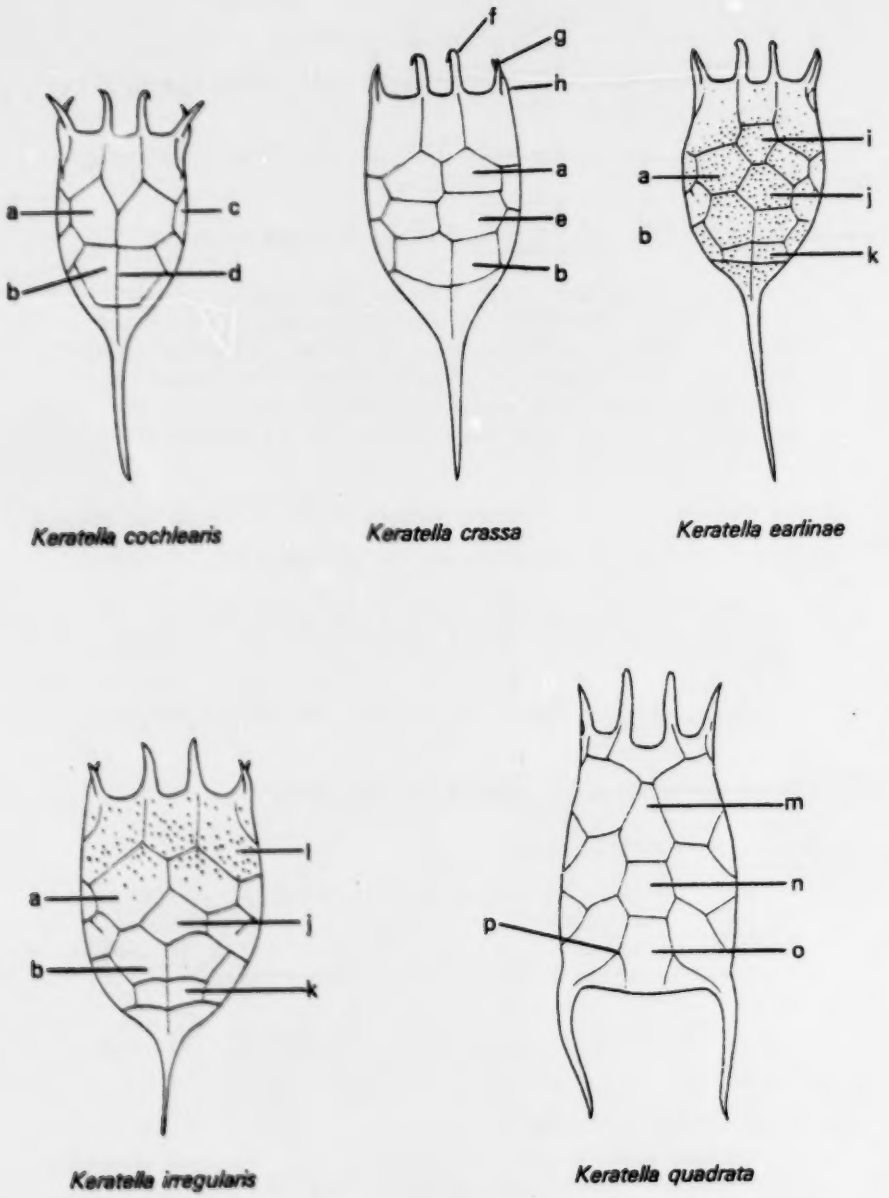



**Fig. 3:** Dorsal pattern of several *Keratella* species:
a - antero-carinal polygon; b - postero-carinal polygon; c - lateral polygon; d - median line;
e - medio-carinal polygon; f - median anterior spine; g - intermediate anterior spine;
h - lateral anterior spine; i - accessory antero-median polygon; j - medial polygon;
k - accessory postero-carinal polygon; l - pustules; m - antero-median polygon;
n - meso-median polygon; o - postero-median polygon; p - lateral ridge.
(Redrawn from Ahlstrom, 1943).

left spine shorter than right spine. Total length 130-295 μ (Plate VII,4).

..... *Keratella valga*

3. Lateral ridges of postero-median polygon branched.

Body subrectangular. Lorica terminates in two nearly equal divergent or slightly bowed posterior spines. Dorsal pattern: row of three polygons located medially the length of dorsal plate. The first two median polygons are hexagons, while the third is generally incomplete (Fig. 3,E). Total length 224-385 μ (Plate VII,2).

..... *Keratella quadrata*

Lateral ridges of postero-median polygon not branched.

Body subrectangular. Dorsal pattern: similar to *Keratella quadrata*. Total length 100-200 μ (Plate VI,6).

..... *Keratella hiemalis*

4. Lorica terminates in single median posterior spine.....5

Posterior spine absent.

Body oblong. Posterior margin rounded. Median spines on anterior dorsal margin longer than lateral spines. Dorsal areolate pattern similar to *Keratella cochlearis* (Fig. 3,A). Total length 89-125 μ (Plate VI,3).

..... *Keratella cochlearis f. tecta*

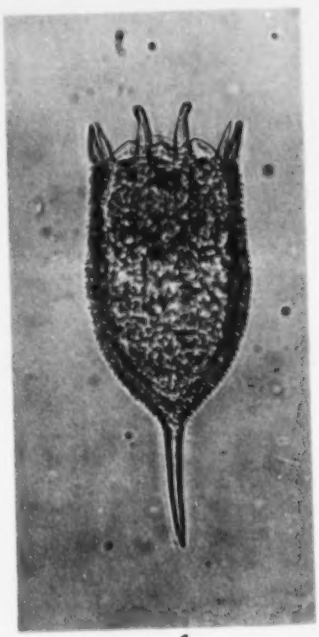
5. Lorica densely hispid.

Dorsal pattern similar to *Keratella cochlearis* (Fig. 3,A) but is obscured by numerous spinelets. Median posterior spine thin. Median line on dorsal surface approximately straight its entire length. Total length 130-225 μ (Plate VI,1).

..... *Keratella cochlearis f. hispida*

Lorica not as above.....6

## PLATE VI



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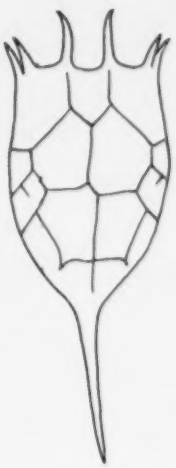

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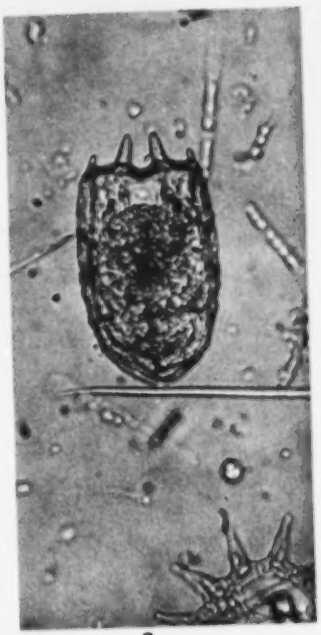

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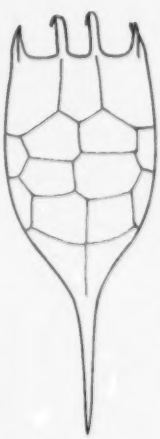

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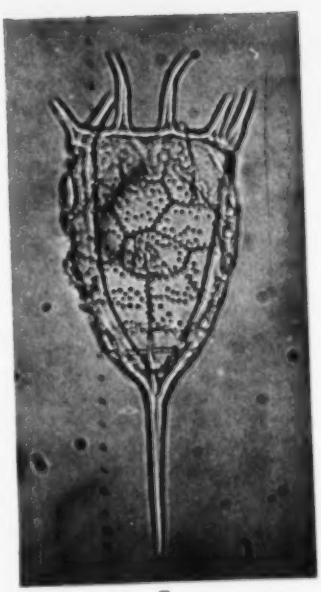

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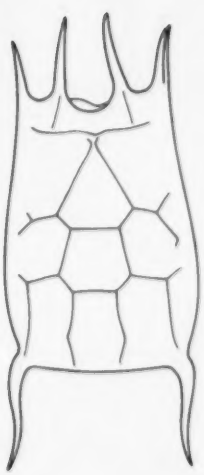

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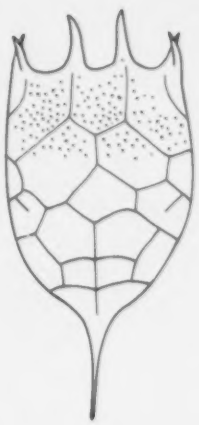
Figs. 1-6: 1. *Keratella cochlearis f. hispida* dorsal view; 2. *K. cochlearis f. robusta* dorsal view; 3. *K. cochlearis f. tecta* dorsal view; 4. *K. crassa* dorsal view; 5. *K. earlinae* dorsal view; 6. *K. hiemalis* dorsal view. (2, 4 redrawn from Ahlstrom, 1943; 6 redrawn from Pejler, 1962).

## PLATE VII



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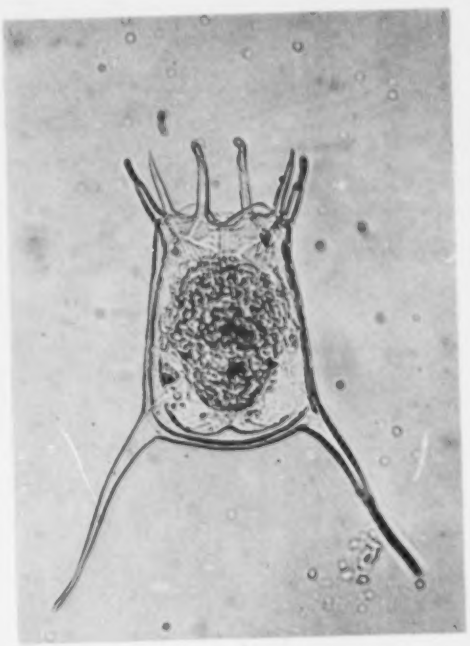

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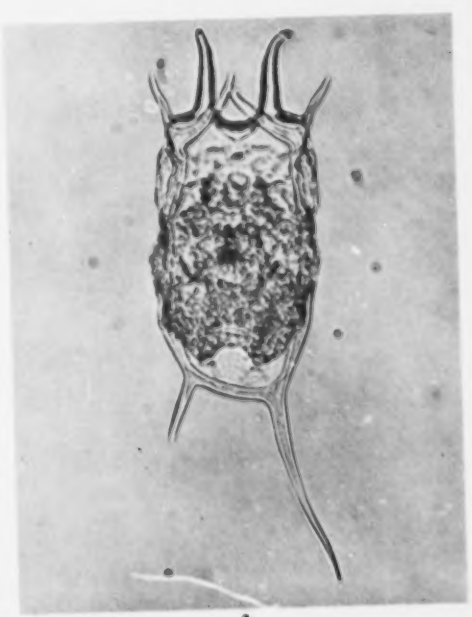

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**Figs. 1-4:** 1. *Keratella irregularis* dorsal view; 2. *K. quadrata* dorsal view; 3. *K. taurocephala* dorsal view; 4. *K. valga* dorsal view lateral anterior spines distorted . (1 redrawn from Ahlstrom, 1943).

6. Median line on dorsal surface straight or has slight indentation towards right behind antero-carinal polygons.....7

Median line on dorsal surface indents to left near second pair of antero-carinal polygons; beyond these polygons the line indents to the right.

Dorsal pattern: antero-carinal polygons typical of *Keratella cochlearis* are mesially divided forming two pairs of polygons (antero-carinal and medio-carinal polygons; Fig. 3,B). Hexagons located posterior to antero-carinal polygons are often completely enclosed. Total length 140-244 µ (Plate VI, 4).

..... *Keratella crassa*

7. Lateral anterior spines widely divergent with tips that curve inward.

Lorica terminates in broad, moderately long posterior spine which may diverge to right. Lateral spines on anterior dorsal margin generally longer than median spines. Median spines curve outward. Dorsal pattern similar to *Keratella cochlearis* (Fig. 3,A). Total length 182-270 µ (Plate VII,3).

..... *Keratella taurocephala*

Lateral anterior spines not as above.....8

8. Dorsal pattern: pentagon located medially (slightly off to right) between antero-carinal polygons and the two pair of posterior polygons (postero-carinal and accessory postero-carinal polygons, Fig. 3,D).

Large pustules present on dorsal and ventral surfaces. Pustules on dorsal plate randomly distributed while those on ventral plate primarily concentrated on upper third of body. Total length 152-212 µ (Plate VII,1).

..... *Keratella irregularis*

Dorsal pattern not as above.....9

9. Dorsal pattern: Hexagon located above medial polygon and between antero-carinal polygons (Fig. 3,C).

Medial polygon is a hexagon situated medially (slightly off to right) between antero-carinal polygons and the two pair of posterior polygons (postero-carinal and accessory postero-carinal polygons). Left antero-carinal polygon is an irregular pentagon. Pustulation prominent. Total length 120-240 μ (Plate VI,5).

..... *Keratella earlinae*

Dorsal pattern not as above.....10

10. Lateral and intermediate spines converge at tips.

Median spines on anterior dorsal margin longer than lateral spines. Median line present on lower two-thirds of dorsal surface, terminating at base of posterior spine. This line may diverge abruptly to right for short distance near middle of body. Dorsal pattern: One pair of complete hexagons located medially (antero-carinal polygons,Fig.3,A). Hexagons (postero-carinal polygons)situated posterior to antero-carinal polygons generally incomplete but may be fully formed. Two or three pairs of lateral polygons located to side of antero-carinal and postero-carinal polygons. Pustules present on dorsal surface. Total length 92-214 μ (Plate V,3).

.....*Keratella cochlearis*[2]

[2]There is considerable doubt among many taxonomists regarding the validity of separating *Keratella cochlearis* into varieties as some investigators have done in the past. This is primarily due to the phenomenon of cyclomorphosis which has been observed for this species. Briefly, cyclomorphosis involves a change in morphology with changing environmental conditions. For example, winter forms of *Keratella cochlearis* often have long spines which diminish in length as summer approaches. The dorsal pattern may also exhibit considerable variability. The use of these characteristics as important taxonomical features for distinguishing varieties is thus questionable for this species. Consequently, morphological variations of *Keratella cochlearis* are designated in this text as forms of the species. The reader is encouraged to consult the works of Ahlstrom (1943), Gallagher (1957), Nauwerck (1972), and Pejler (1957 and 1962b) which discuss in detail cyclomorphosis, theories presented for its occurrence, and taxonomical problems resulting from this process.

Lateral and intermediate anterior spines do not converge at tips.....11

11. Postero-carinal polygons complete.

Lorica terminates in long median posterior spine and usually larger than typical *Keratella cochlearis*. Anterior spines are also larger. Median line on dorsal surface may be straight or have slight indentation towards right behind antero-carinal polygons. Three pairs of lateral polygons located to side of antero-carinal polygons. Total length 185-260 μ (Plate VI,2).

..... *Keratella cochlearis f. robusta*

Postero-carinal polygons incomplete.

Lorica terminates in moderately long median posterior spine.Dorsal pattern very distinct; similar to *Keratella cochlearis* (Fig. 3,A). Total length 185-320 μ (Plate V,4).

..... *Keratella cochlearis f. faluta*

Ref.: Ahlstrom, 1943; Amren, 1964; Chengalath et. al., 1971; Nauwerck, 1972; Pejler, 1957, 1962c; Sudzuki, 1964; Wulfert, 1956.

## *NOTHOLCA*[3] Gosse, 1886

Body oblong-ovate, elongate or conical. Anterior dorsal margin with six spines. Posterior end of lorica rounded or terminates in generally broad spine of varying length which in most species does not taper to point. Dorsal plate either smooth, pustulated, or striated. Foot absent. Trophi malleate.

[3]Species differentiation is often confusing in the genus *Notholca* due to the wide variety of morphological forms that generally appear in the literature for a particular species. A revision in the species classification is needed. The reader is encouraged to consult Pejler (1957) for a discussion on some of the taxonomic problems encountered with this genus.

1. Body elongate.....2

   Body oblong or ovate.....3

2. Lorica terminates in broad posterior spine of varying length which does not taper to point.

   Total length 137-260 μ (Plate VIII,1).

   ..... *Notholca acuminata*

   Lorica terminates in generally short narrow spine which tapers to point.

   Total length 160-180 μ (Plate VIII,2).

   ..... *Notholca foliacea*

3. Intermediate and median anterior dorsal spines longer than lateral anterior spines.

   Dorsal plate striated. Posterior end of lorica rounded or truncate. Total length 192-285 μ (Plate VIII,3).

   ..... *Notholca laurentiae*[4]

   Intermediate anterior dorsal spines shorter than lateral and median anterior spines.

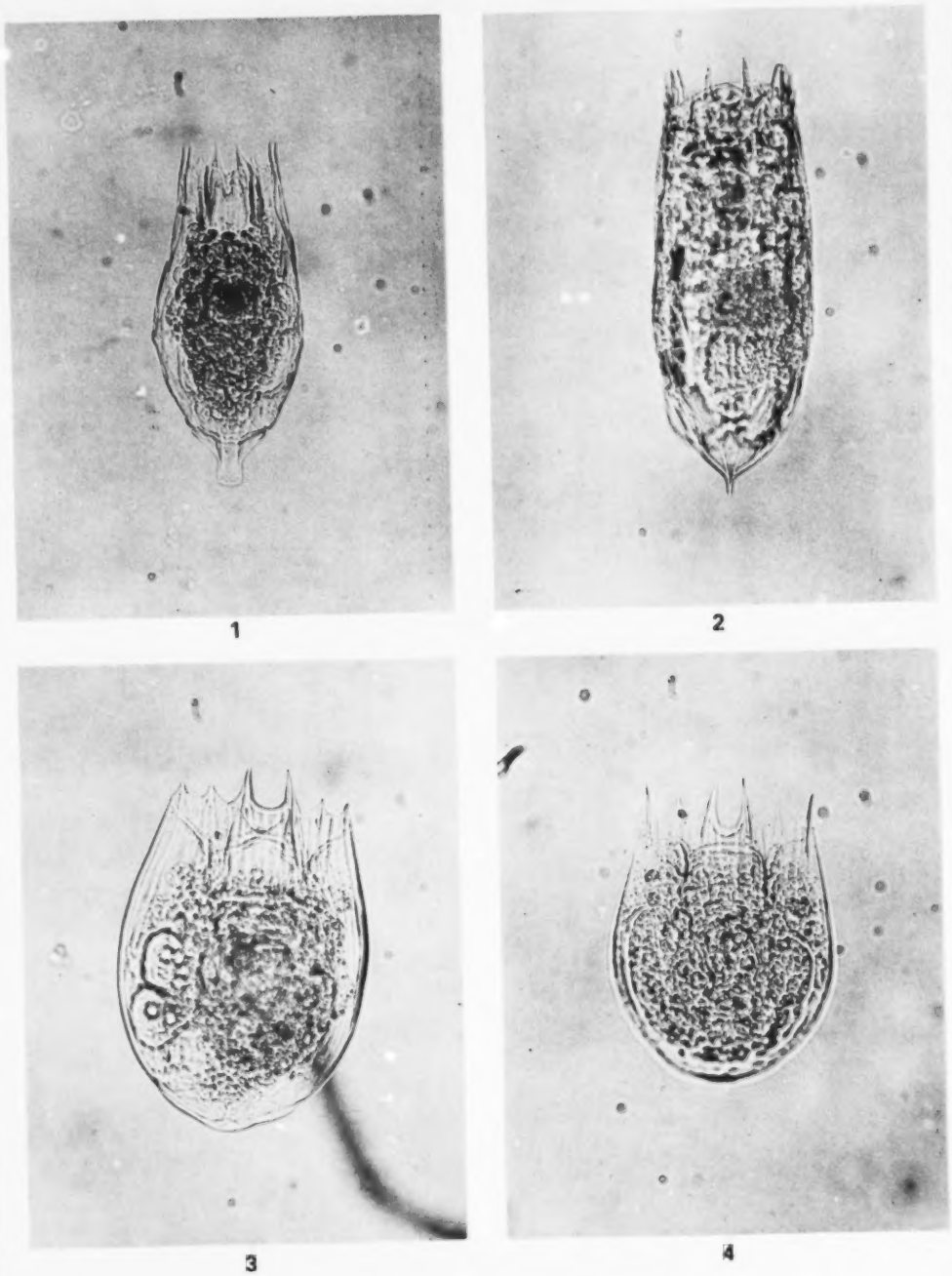
   Dorsal plate not striated. Posterior end of lorica rounded. Total length 100-180 μ (Plate VIII,4).

   ..... *Notholca squamula*

Ref.: Amren, 1964; Carlin, 1943; Chengalath et. al., 1971; Nauwerck, 1972; Stemberger, 1976.

[4]*Notholca laurentiae* has recently been described as a new species by Stemberger, 1976. Many Great Lakes taxonomists have previously identified this species as *N. striata*.

## PLATE VIII




**Figs.1-4:** 1. *Notholca acuminata* dorsal view; 2. *N. foliacea* dorsal view; 3. *N. laurentiae* dorsal view; 4. *N. squamula* dorsal view.

## *PLATYIAS* Harring, 1913

Body subrectangular or ovate. Anterior margin with two or ten spines. Two broad posterior spines present. Foot opening may be bordered by two short spines. Trophi malleate. (Note: some taxonomists include members of this group in the genus *Brachionus*).

1. Anterior margin with ten spines.

   Body subrectangular. Median spines longest and curve outward. Foot opening located asymmetrically on posterior margin and bordered by two short spines. Total length 165-265 μ (Plate IX,1).
   Generally found in littoral areas; only occasional migrant in plankton.

   ..... *Platyias patulus*

Ref.: Ahlstrom, 1940; Pennak, 1953.

## *TRICHOTRIA* Bory de St. Vincent, 1827

Body conical or spindle-shaped. Dorsal plate enlarged to form shield-like structure around body. Neck region clearly defined from rest of lorica. Foot composed of three segments. Two spines often present on second segment. Third foot segment bears two long toes which taper to point. Small spine may be present between toes. Trophi malleate.

1. Small spine not present between toes.

   Second foot segment bears two spines of varying length. Body length 200-350 μ (Plate IX,2).
   Generally found in littoral areas; only occasional migrant in plankton.

   ..... *Trichotria tetractis*

Ref.: Herrick, 1885; Ruttner-Kolisko, 1974; Wulfert, 1956.

## *LEPADELLA* Bory de St. Vincent, 1826

Body ovate or oblong. Anterior and posterior margins with U or V-shaped sinus. Foot composed of three segments. Third foot segment bears two moderately long toes which taper to point. Trophi malleate.

1. Anterior ventral margin with deep V-shaped sinus, the sides of which curve slightly outward.

   Anterior dorsal margin with wide U-shaped sinus. Posterior dorsal margin with shallow V-shaped aperture. First and second foot segments approximately equal length but shorter than third segment. Toe length about one-third length of lorica. Body length 100-108 μ (Plate IX,3).
   Generally found in littoral areas; only occasional migrant in plankton.

   ..... *Lepadella patella*

Ref.: Harring, 1917; Pejler, 1962a; Wulfert, 1956.

## *LECANE* Nitzsch, 1827

Body ovate or oblong. Anterior dorsal margin with shallow or deep V-shaped sinus. Foot composed of two segments. First segment may not be readily observable. Second segment bears two toes which taper to point. Trophi malleate.

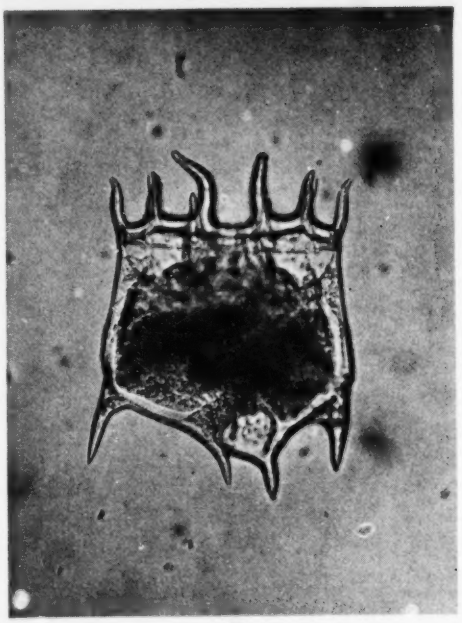
1. Toes approximately one-third total length.

   Body ovate. Anterior dorsal margin with deep V-shaped sinus. Body length 125-135 μ (Plate X,1).
   Generally found in littoral or benthic areas; only occasional migrant in plankton.

   ..... *Lecane luna*

Ref.: Harring and Myers, 1926.

## PLATE IX



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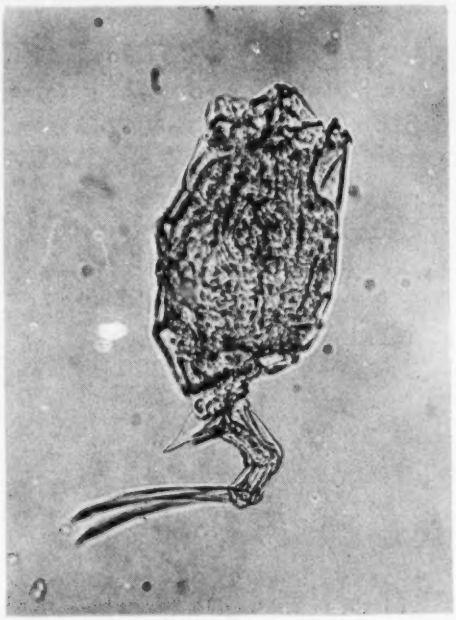

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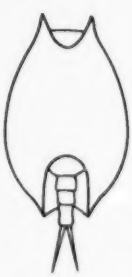

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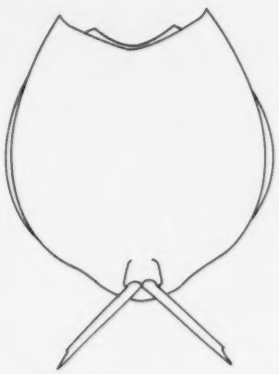
**Figs. 1-3:** 1. *Platyias patulus* dorsal view; 2. *Trichotria tetractis* lateral view; 3. *Lepadella patella* ventral view. (3 redrawn from Edmondson, 1959).

## PLATE X



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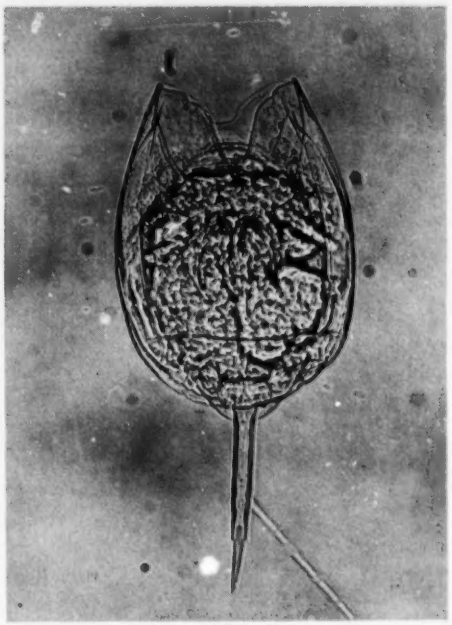

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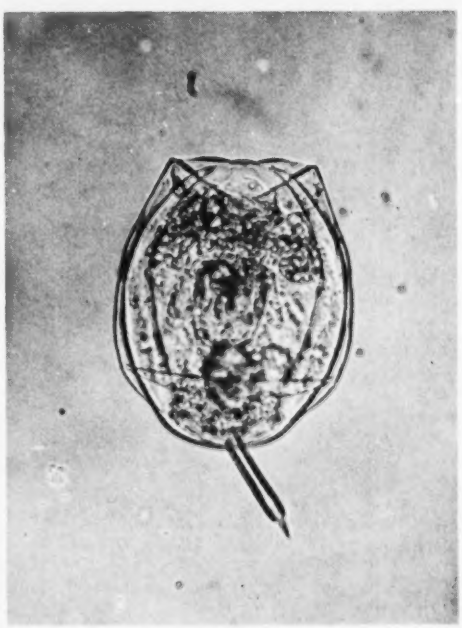

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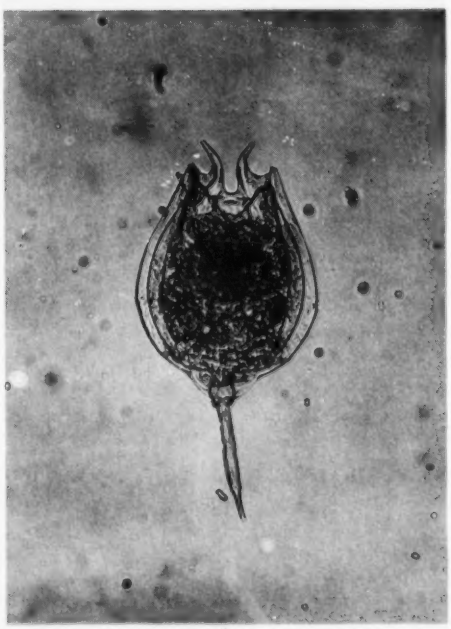

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**Figs. 1- 4:** 1. *Lecane luna* ventral view; 2. *Monostyla bulla* ventral view; 3. *M. lunaris* ventral view; 4. *M. quadridentata* ventral view. (1 redrawn from Harring and Myers, 1926).

## *MONOSTYLA* Ehrenberg, 1830

Body ovate or oblong. Anterior dorsal margin with shallow or deep V-shaped sinus. Foot composed of two segments. First segment may not be readily observable. Second segment bears single long toe which is much longer than foot segments. Toe tapers to point. Trophi malleate. (Note: some taxonomists include members of this group in the genus *Lecane*).

1. Lorica width approximately three-fifths length.....2

   Lorica width approximately three-fourths length.

   Body broadly ovate. Anterior dorsal and ventral margin with deep V-shaped sinus. Dorsal sinus bordered by two broad outcurved spines on each side of opening. First and second foot segments narrow and oblong. Toe length approximately one-third total length. Body length 130-142 μ (Plate X,4).
   Generally found in littoral or benthic areas; only occasional migrant in plankton.

   ..... *Monostyla quadridentata*

2. Anterior dorsal margin with V-shaped sinus bearing a median notch.

   Body oblong. Anterior ventral margin with deep V-shaped sinus rounded at posterior margin. First foot segment small. Second segment larger than first, triangular in shape. Toe length approximately one-third total length. Body length 112-118 μ (Plate X,2).
   Generally found in littoral or benthic areas; only occasional migrant in plankton.

   ..... *Monostyla bulla*

   Anterior dorsal margin with V-shaped sinus rounded posteriorly.

   Body broadly ovate. First foot segment small and obscure. Second segment large and rectangular. Toe length approximately one-third total length. Body length 100-118 μ (Plate X,3).
   Generally found in littoral or benthic areas; only occasional migrant in plankton.

   ..... *Monostyla lunaris*

Ref.: Gosse, 1851; Harring and Myers, 1926; Herrick, 1885.

## *CEPHALODELLA* Bory de St. Vincent, 1826

Body cylindrical. Head and tail regions clearly defined from rest of body. Lateral fissure present along length of body. Foot small and bears two toes. Trophi virgate.

1. Toe length approximately one-third total length.

   Foot conical. Toes long, slender and taper to point. Total length 250-300 μ (Plate XI,1). Generally found in littoral or benthic areas; only occasional migrant in plankton.

   ..... *Cephalodella gibba*

Ref.: Harring and Myers, 1924; Wulfert, 1956.

## *TRICHOCERCA* Lamarck, 1801

Body generally cylindrical but asymmetric. Anterior dorsal margin often with one or two spines of varying length. Foot short and conical. Two unequal toes present. Right toe (dorsal view) often obscure or reduced. Left toe generally very long; may be approximately as long as body. Small substyles usually present adjacent to toes. Trophi virgate.

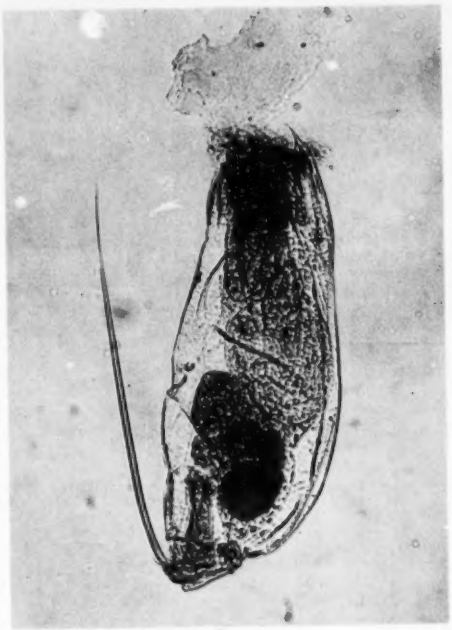
1. Anterior dorsal margin with spines or "tooth-like structures"...2

   Anterior dorsal margin without spines or "tooth-like structures".....7

2. Anterior dorsal margin with only one spine or "tooth-like structure".....3

## PLATE XI

1



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**Figs. 1-4:** 1. *Cephalodella gibba* lateral view; 2. *Trichocerca cylindrica* lateral view; 3. *T. lata* dorsal view; 4. *T. longiseta* lateral view. (1 redrawn from Harring and Myers, 1924; 3 redrawn from Jennings, 1902).

Anterior dorsal margin with two or more spines or "tooth-like structures".....4

3. Tip of anterior spine bends downward over anterior opening of lorica to form hook.

Body long and cylindrical. Head region set off from lorica by shallow groove. Right toe minute or absent. Left toe approximately as long as body. Small substyle present on left side of main toe. Body length 260-355 μ (Plate XI,2).

..... *Trichocerca cylindrica*

Tip of anterior spine not as above.

Body broadly ovate. Anterior dorsal margin extended to form triangular "tooth-like structure". Anterior region with numerous longitudinal folds. Posterior margin of lorica symmetrical. Right toe reduced and extends obliquely across base of left toe. Left toe approximately one-half to two-thirds length of body. Minute substyle present on each side of left toe. Body length 180-200 μ (Plate XII,2).

..... *Trichocerca multicrinis*

4. Two anterior spines present.....5

Nine anterior spines present.

Body short and cylindrical. Head region set-off from body by shallow groove. Toes close together, appearing at times that only one toe is present. Right toe shorter than left toe. Left toe approximately one-third length of body. Body length 95 μ (Plate XIII,1).

..... *Trichocerca rousseleti*

5. Body short, broad, cylindrical and strongly curved.

Head region set-off from body by shallow groove. Single dorsal ridge present. Toes nearly equal in length. Length of left toe approximately equal to diameter of body. Two substyles present at base of each toe. Body length 140-175 μ (Plate XII,3).

Generally found in littoral areas; only occasional migrant in plankton.

..... *Trichocerca porcellus*

Body not as above.....6

6. Two dorsal ridges present.

Body long and cylindrical. Right spine considerably longer than left spine. Right toe absent. Left toe approximately two-thirds length of body or longer. Small scale-like substyles present on each side of toe. Body length 300 μ (Plate XI,4).

..... *Trichocerca longiseta*

Dorsal ridges absent.

Body elongate and cylindrical. Length of toes approximately equal. Toe length less than one-half body length. Body length 150-200 μ (Plate XIII,2).

..... *Trichocerca similis*

7. Anterior margin with folds.....8

Anterior margin smooth, without folds.....9

8. Left toe length less than one-third body length.

Body short and cylindrical. Right toe absent. Body length 180 μ (Plate XIII,3).
Generally found in littoral or benthic areas; only occasional migrant in plankton.

..... *Trichocerca stylata*

Left toe length more than one-third body length.

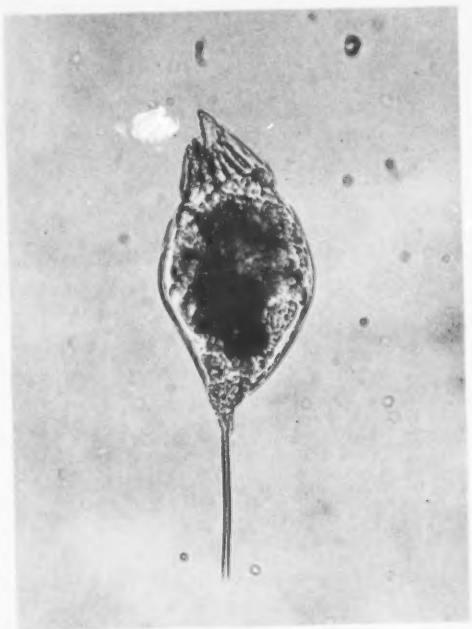
Body short, broad and cylindrical. Right toe absent. Left toe length approximately four-fifths body length but variable. One short substyle present adjacent to toe. Body length 85-110 μ (Plate XII,4).

..... *Trichocerca pusilla*

9. Two distinct dorsal ridges extend approximately to middle of lorica.

## PLATE XII

1



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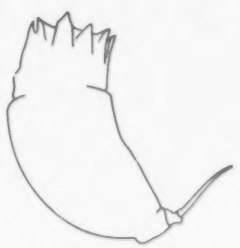
**Figs. 1-4:** 1. *Trichocerca mucosa* dorso-dextral view; 2. *T. multicrinis* lateral view; 3. *T. porcellus* lateral view; 4. *T. pusilla* lateral view. (1, 3, 4 redrawn from Jennings, 1902).

## PLATE XIII



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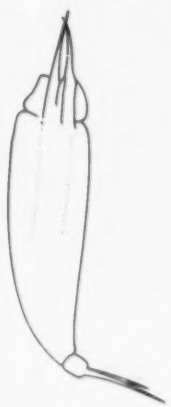

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3

**Figs. 1-3:** 1. *Trichocerca rousseleti* lateral view; 2. *T. similis* dorsal view; 3. *T. stylata* lateral view. (1-3 redrawn from Jennings, 1902).

Body broadly oblong. Right toe minute. Left toe approximately as long as body. Three or four substyles present adjacent to left toe. Body length 180-200 μ (Plate XII,1).
Generally found in littoral or benthic areas; only occasional migrant in plankton.

..... *Trichocerca mucosa*

Dorsal ridges absent or not as above.

Body broadly ovate. Posterior margin of lorica asymmetrical. Foot set off on left side of body. Left toe approximately four-fifths length of body. Three short unequal substyles present adjacent to toe. Body length 170-180 μ (Plate XI,3).
Generally found in littoral or benthic areas; only occasional migrant in plankton.

..... *Trichocerca lata*

Ref.: Gosse, 1851; Jennings, 1902; Nauwerck, 1972; Pejler, 1962; Ruttner-Kolisko, 1974; Stokes, 1896; Wulfert, 1956.

## *CHROMOGASTER* Lauterborn, 1893

Body ovate or saccíform. Lorica divided into dorsal and ventral plate. Corona bears finger-shaped process. Ciliated papillae present on apical field. Foot absent. Trophi virgate. Body length 100-200 μ (Plate XIV,1).

Only one species..... *Chromogaster ovalis*

Ref.: Carlin, 1943; Chengalath et. al., 1971; Pennak, 1953; Ruttner-Kolisko, 1974.

## *GASTROPUS* Imhof, 1898

Body irregularly ovate and compressed laterally. Foot opening located medially or near posterior portion of ventral

plate. Foot annulated. One or two toes present. Toe(s) short and tapered to point. Trophi virgate.

1. Foot opening located medially on ventral plate.

Foot terminates in single toe. Body length 75-205 μ (Plate XIV,2).

..... *Gastropus stylifer*

Ref.: Pejler, 1957; Ruttner-Kolisko, 1974; Sudzuki, 1964.

## *TYLOTROCHA* Harring and Myers, 1922

Body slender and spindle-shaped, bulging markedly outward near mid-length then tapering posteriorly. Head region separated from body by shallow groove. Two dorsal antennae present. Foot moderately long and annulated. Only one toe present. Trophi virgate. Total length 175-250 μ (Plate XIV,3).

Only one species..... *Tylotrocha monopus*

Ref.: Edmondson, 1959; Harring and Myers, 1924.

## *ASPLANCHNA* Gosse, 1850

Body sacciform and highly transparent. Internal organs clearly visible. Head sparcely ciliated with single row of cilia. Foot absent. Trophi incudate. Body length 420-1500 μ.

1. Pedal gland present near urogenital opening (Plate XIV,4).

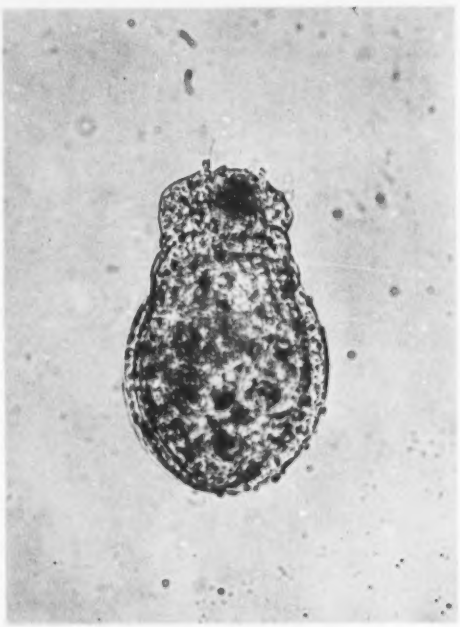
..... *Asplanchna herricki*

Pedal gland absent (plate XIV,5).

..... *Asplanchna priodonta*

Ref.: Gosse, 1850; Herrick, 1885; Ruttner-Kolisko, 1974: Sudzuki, 1964.

## PLATE XIV



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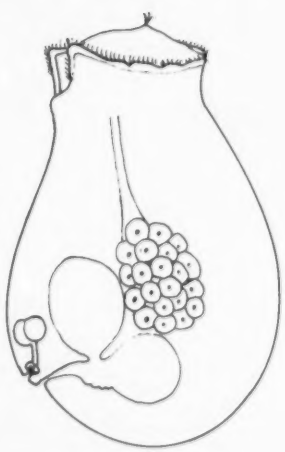

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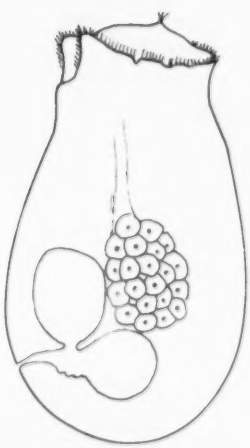

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**Figs. 1-5:** 1. *Chromogaster ovalis* dorsal view; 2. *Gastropus stylifer* lateral view; 3. *Tylotrocha monopus* dorsal view; 4. *Asplanchna herricki* lateral view; 5. *A. priodonta* lateral view. (3 redrawn from Harring and Myers, 1924; 4, 5 redrawn from Voigt, 1957).

## *PLOESOMA* Herrick, 1885

Body oblong. Dorsal surface convex; ventral surface convex or flattened. Lorica with ridges forming various textures. Dorsal plate may be extended anteriorly to form head shield. Foot opening located medially on ventral plate. Foot large and annulated. Two toes present. Toes short, approximately equal length and taper to point. Trophi virgate.

1. Head shield present.....2

   Head shield absent.

   "Size large, with frothy looking epidermis which gives the thin flexible lorica an areolate appearance" (Edmondson, 1959). Body length 250-600 µ (Plate XV,1).

   ..... *Ploesoma hudsoni*

2. Head shield with small, broad spine located medially on anterior margin.

   Dorsal surface with one pair of short transverse ridges located slightly posterior to middle of lorica. Anterior to these markings are two ridges which diverge to anterior margin of lorica. Posterior to transverse lines are two ridges, one on each side of median line. Body length 150-300 µ (Plate XV,2&3).

   ..... *Ploesoma lenticulare*

   Head shield without spines.

   Dorsal surface with ridges forming large medial triangle. Situated adjacent to the two lateral sides of triangle are two pairs of ridges. The inner pair converge near posterior margin of lorica. The outer pair of ridges converge but do not meet, terminating at posterior margin. Body length 130-300 µ (Plate XV,4&5).

   ..... *Ploesoma truncatum*

Ref.: Edmondson, 1959; Herrick, 1885; Nauwerck, 1972; Ruttner-Kolisko, 1974; Wulfert, 1956.

## *POLYARTHRA* Ehrenberg, 1834

Body subrectangular or subsquare. Illoricate. Anterior third of body with two bundles of foliate or fin-like appendages on both the dorsal and ventral surfaces. A generally distinct midrib extends almost entire length of each fin. Foot absent. Trophi virgate.

1. Fins very broad; fin width 50-70 μ.

   Fins entend only short distance beyond end of body. Ratio (in percent) of fin length to body length 100-110. Body length 160-180 μ (Plate XVI,2).

   ..... *Polyarthra euryptera*

   Fins slender or very narrow, fin width less than 50 μ.....2

2. Fins extend well beyond posterior end of body.....3

   Fins generally extend only slightly beyond posterior end of body..... .....4

3. Fin width one-tenth fin length.

   Ratio (in percent) of fin length to body length 120-170. Body length 90-130 μ (Plate XVI,1).

   ..... *Polyarthra dolichoptera*

   Fin width less than one-tenth fin length.

   Ratio (in percent) of fin length to body length 120-150. Body length 65-100 μ (Plate XVI,4).

   ..... *Polyarthra remata*

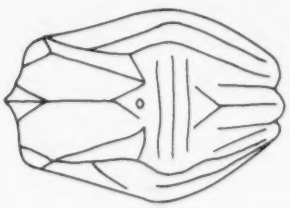
4. Body length 140-195 μ.

   Fins slender; fin width 20-40 μ. Ratio (in percent) of fin length to body length 100-110 (Plate XVI,3).

   .....*Polyarthra major*

## PLATE XV

1



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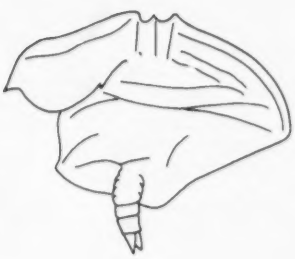

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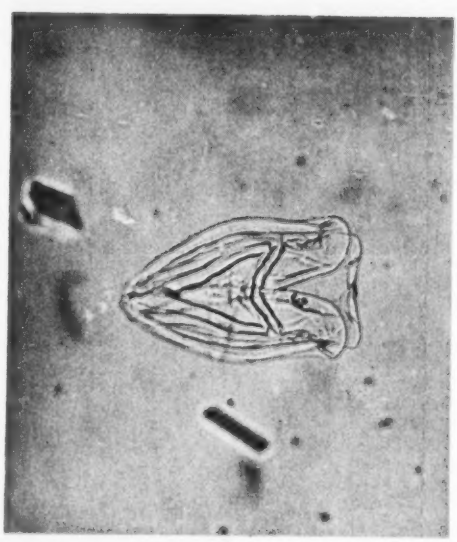

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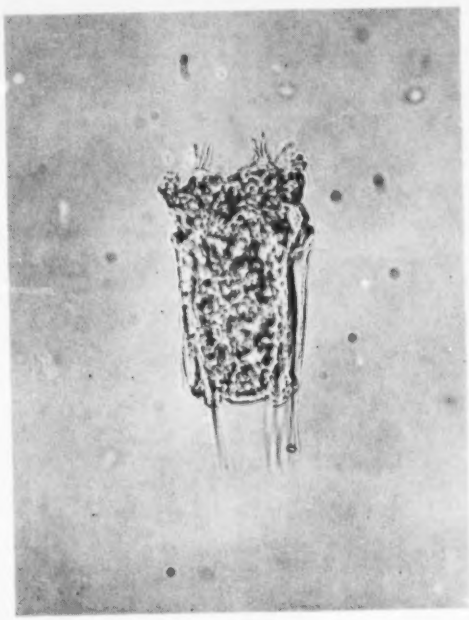
**Figs. 1-5:** 1. *Ploesoma hudsoni* lateral view; 2. *P. lenticulare* dorsal view; 3. *P. lenticulare* lateral view; 4. *P. truncatum* dorsal view; 5. *P. truncatum* lateral view. (2 redrawn from Edmondson, 1959; 3 redrawn from Chengalath et. al., 1971).

## PLATE XVI



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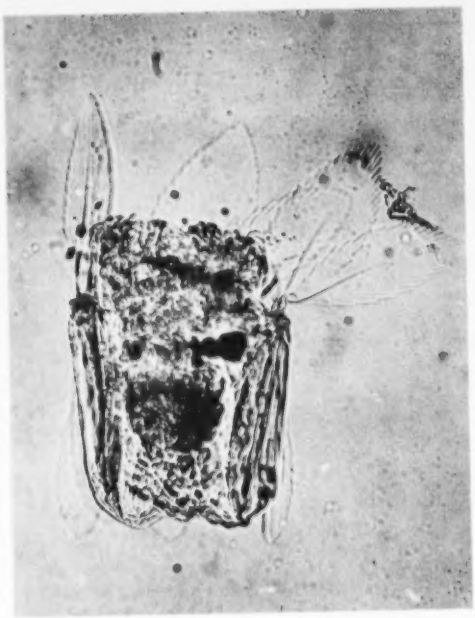

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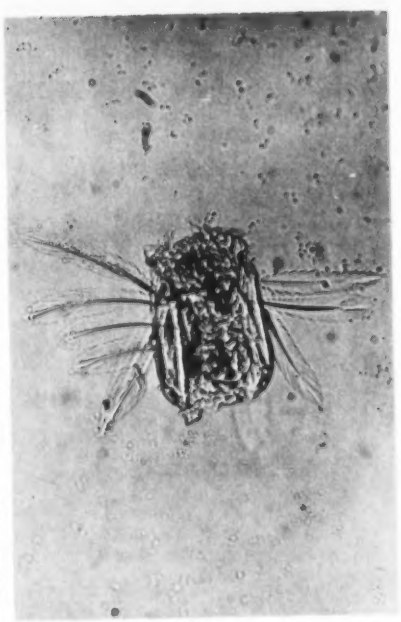


5

**Figs. 1-5:** 1. *Polyarthra dolichoptera* dorsal view; 2. *P. euryptera* dorsal view; 3. *P. major* dorsal view; 4. *P. remata* dorsal view; 5. *P. vulgaris* dorsal view.

Body length 90-145 μ.

Fins slender. Ratio (in percent) of fin length to body length 100-110 (Plate XVI,5).

..... *Polyarthra vulgaris*

Ref.: Carlin, 1943; Edmondson, 1959; Nauwerck, 1972; Pejler, 1957; Pourriot, 1965; Ruttner-Kolisko, 1974; Sudzuki, 1964.

## *SYNCHAETA*[5] Ehrenberg, 1832

Body conical or vase-shaped. Round prominent ciliated auricles present on each side of head. Apical field generally elevated above coronal cilia. Four styli present on apical field. One or two eyes present. Lateral antennae located on posterior margin of body. Foot unsegmented. Two toes present. Toes short, approximately equal length and taper to point. Trophi virgate.

1. Foot very broad.

Body elongate and conical. Toes minute. One toe often retracted. Total length 275-290 μ (Plate XVII,1).

..... *Synchaeta asymmetrica*

Foot not as above.....2

2. Teeth present on each uncus of trophi.....3

Teeth absent on each uncus of trophi.

Body large, broad and sub-conical. Two fleshy ciliated protuberances present on top of apical field. Foot short and stout, terminating in two minute toes. Lateral antennae

[5]Species differentiation in the genus *Synchaeta* is often difficult. The body shape, which is one of the primary distinquishing characteristics used by taxonomists to distinquish species is generally distorted in preserved samples. Examination of trophi characteristics and the specimen in the unpreserved state may be required for species identification.

situated on ventral side of body. Total length 340-408 μ (Plate XVII,4).

..... *Synchaeta pectinata*

3. Distinct notch divides row of smaller teeth on uncus into two groups (i.e. Two groups of three or one group of three and another group of four).

Body small, conical and swollen at sides. Resembles *Synchaeta lakowitziana* but smaller and sides are more pronouncely swollen. Lateral antennae situated one-third from posterior end of body and slightly ventral in position. Foot bears two minute toes. Total length 200-244 μ (Plate XVII,3).

..... *Synchaeta oblonga*

Row of teeth on uncus not divided into two groups by a distinct notch.....4

4. Foot long and narrow.

Body elongate and conical. Foot bears two minute toes. Lateral antennae situated approximately one-third from posterior end of body, and slightly ventral in position. Total length 242-292 μ (Plate XVII,5).

..... *Synchaeta stylata*

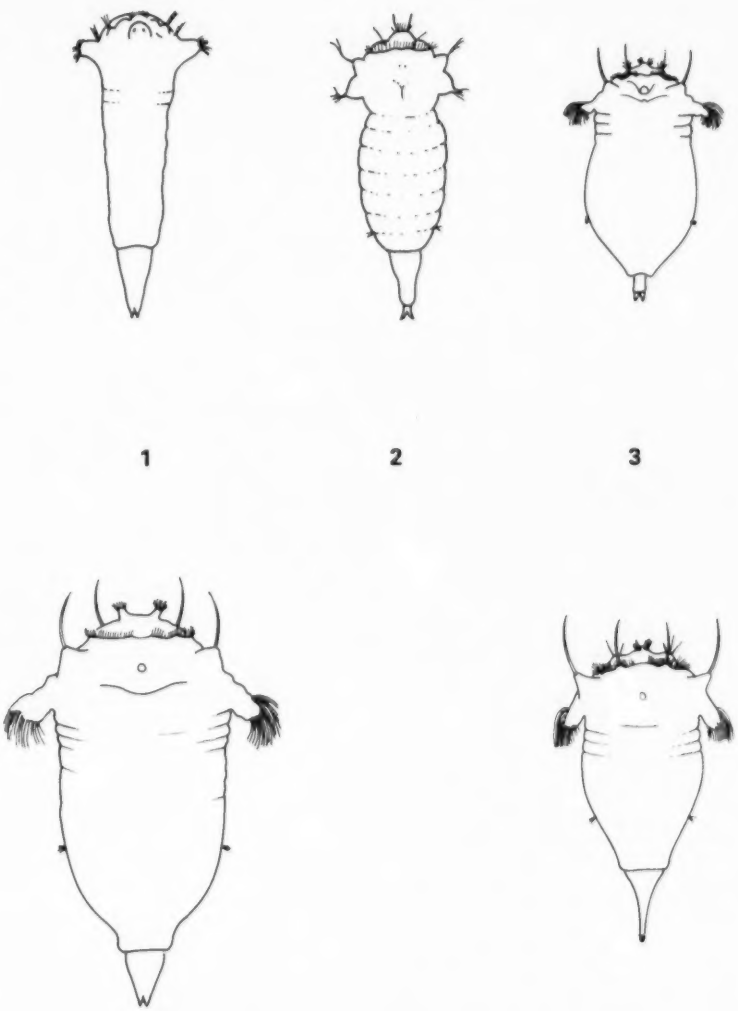
Foot not as above.

Body conical and only slightly swollen at sides. Foot bears two minute toes which are widely separated from each other. Lateral antennae situated one-third from posterior end of body. Each uncus of trophi bears one anterior tooth which is clearly separated from row of smaller teeth. The number of teeth in this row numbers six on one uncus and seven on the other. Total length 250-280 μ (Plate XVII,2).

..... *Synchaeta lakowitziana*

Ref.: Hauer, 1952; Koch-Althaus, 1963; Lucks, 1930; Pejler, 1957, 1962c; Pourriot, 1965; Rousselet, 1902; Ruttner-Kolisko, 1974; Sudzuki, 1964.

## PLATE XVII



1 2 3

4 5

**Figs. 1-5:** 1. *Synchaeta asymmetrica* dorsal view; 2. *S. lakowitziana* dorsal view; 3. *S. oblonga* dorsal view; 4. *S. pectinata* dorsal view; 5. *S. stylata* dorsal view. (1 redrawn from Koch-Althaus, 1963; 2. redrawn from Lucks, 1930; 3-5 redrawn from Rousselet, 1902).

## *FILINIA* Bory de St. Vincent, 1824

Body ovate. Anterior region with two filament or bristle like structures of varying length which originate below head region. Posterior region with terminal or subterminal filament. Foot absent. Trophi malleoramate.

1. Posterior region with subterminal filament located on ventral surface.

   Filament more than 5 μ from posterior end of body. Body length 145-208 μ (Plate XVIII,1).
   ..... *Filinia longiseta*

   Posterior region with terminal filament.

   Filament located no more than 5 μ from posterior end of body. Body length 145-208 μ (Plate XVIII,2).
   ..... *Filinia terminalis*

Ref.: Chengalath et. al., 1971; Edmondson, 1959; Nauwerck, 1972; Pejler, 1957; Sudzuki, 1964.

## *POMPHOLYX* Gosse, 1851

Body ovate or oblong. Longitudinal grooves may be present on lorica. Two eye spots present. Eggs attached behind body after deposition by thread-like secretion. Foot absent. Trophi malleoramate.

1. Lorica with four longitudinal grooves; body four lobed in cross section.

   Total length 120 μ (Plate XVIII,3).
   ..... *Pompholyx sulcata*

Ref.: Edmondson, 1959; Gosse, 1851; Hudson, 1885.

## *TESTUDINELLA* Bory de St. Vincent, 1826

Body ovate or conical, flattened and transparent. Head region funnel-shaped, but generally withdrawn into body in preserved specimens. Stomach kidney-shaped. Long prominent band of muscle located on each side of stomach extends from sides of head to posterior third of body. Two eye spots present. Foot opening located medially or posteriorly on ventral plate. Foot long, annulated and retractile; terminating in ciliary band. Trophi malleoramate.

1. Foot opening round and located medially on ventral plate.

   Body ovate. Body length 120-300 µ (Plate XVIII,4). Generally found in littoral areas; only occasional migrant in plankton.

   ..... *Testudinella patina*

Ref.: Herrick, 1885; Pennak, 1953; Wulfert, 1956.

## *HEXARTHRA* Schmarda, 1854

Body with six hollow appendages originating on upper third of body. Long bristle-like structures bearing small spines present at end of arms. Trophi malleoramate.

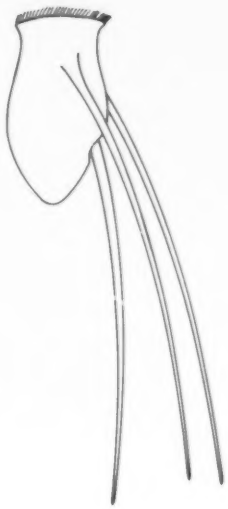
1. Corona expanded ventrally to form "lip" which extends over base of ventral arm.

   Body length 300 µ (Plate XIX,1).

   ..... *Hexarthra mira*

Ref.: Bartos, 1948; Pennak, 1953.

## PLATE XVIII



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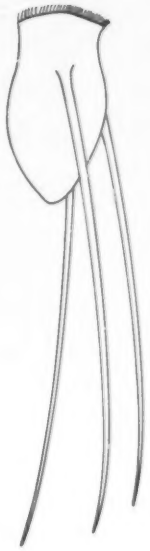

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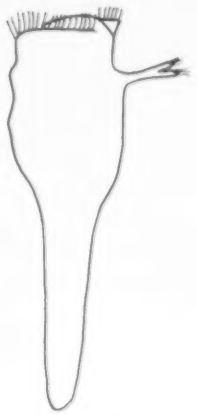
**Figs. 1-4**: 1. *Filinia longiseta* lateral view; 2. *F. terminalis* lateral view; 3. *Pompholyx sulcata* ventral view; 4. *Testudinella patina* ventral view.

## PLATE XIX

1



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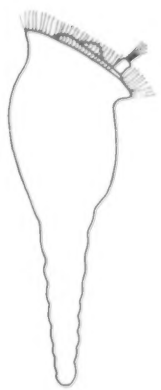

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**Figs. 1-4:** 1. *Hexarthra mira* lateral view; 2. *Conochiloides dossuarius* lateral view; 3. *Conochilus hippocrepis* lateral view; 4. *C. unicornis* lateral view. (1 redrawn from Pennak, 1953; 2-4 redrawn from Voigt, 1957).

## *CONOCHILOIDES* Hlava, 1904

Body conical, tapering to long, unsegmented retractile foot. Two lateral antennae located on ventral surface below corona. Antennae may or may not be fused. Dorsal antennae small. Gelatinous mass often surrounds foot and lower part of body. Toes absent. Trophi malleoramate.

1. Lateral antennae fused.

    Total length highly variable (Plate XIX,2).
    ..... *Conochiloides dossuarius*

Ref.: Chengalath et. al., 1971; Edmondson, 1959; Pennak, 1953.

## *CONOCHILUS* Ehrenberg, 1834

Body vase-shaped, tapering to long, unsegmented retractile foot. Two lateral antennae located on apical field. Antennae may or may not be fused. Toes absent. Individuals often found in colonies, although may be solitary in plankton. Trophi malleoramate.

1. Lateral antennae separate.

    Total length highly variable (Plate XIX,3).
    ..... *Conochilus hippocrepis*

  Lateral antennae fused.

    Total length highly variable (Plate XIX,4).
    ..... *Conochilus unicornis*

Ref.: Chengalath et. al., 1971; Edmondson, 1959; Pejler, 1957; Pennak, 1953.

## *COLLOTHECA* Harring, 1913

Body spindle-shaped, tapering to long, unsegmented, retractile foot. Illoricate. Coronal funnel may or may not have lobes. When present, lobes have long bristles. Tip of foot tapered or has thickening. Trophi uncinate.

1. Coronal funnel with dorsal and ventral lobes.

    Dorsal lobe with two eye spots. Foot with thickening at tip. Total length 300-455 μ (Plate XX,1).

    ..... *Collotheca mutabilis*

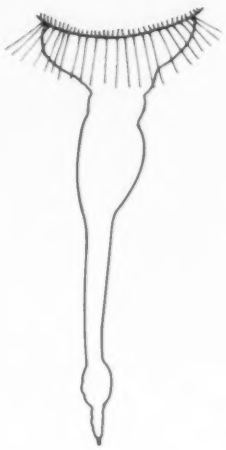
Coronal funnel without lobes.

    Five fleshy prominences with short radiating setae located within ciliated corona. Eyes absent. Foot tapered. Total length 300-500 μ (Plate XX,2&3).

    ..... *Collotheca pelagica*

Ref.: Hudson, 1885; Pejler, 1957; Rousselet, 1893; Ruttner-Kolisko, 1974; Sladecek, 1968.

## PLATE XX



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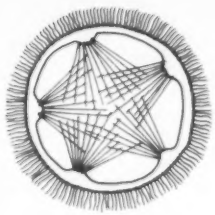

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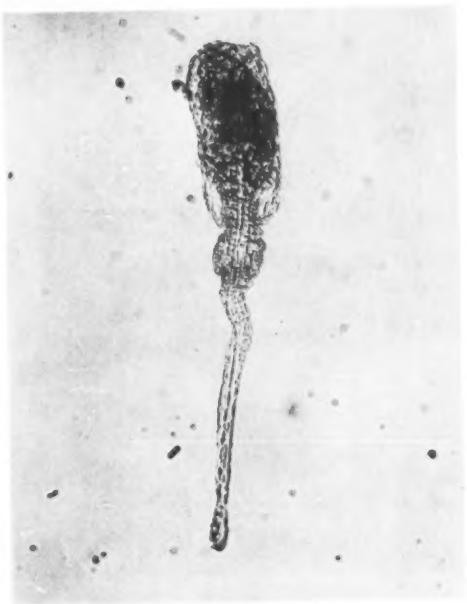

3

**Figs. 1-3:** 1. *Collotheca mutabilis* lateral view; 2. *C. pelagica* view inside corona from above; 3. *C. pelagica* lateral view. (1 redrawn frcm Edmondson, 1959; 2 redrawn from Rousselet, 1893).

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